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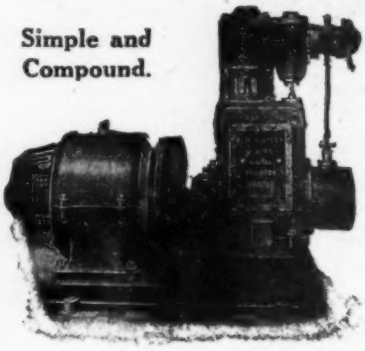

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TO "ELECTRICAL REVIEW" READERS.

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PLAIN SPEAKING.

WE commend to the attention of all our readers the straightforward speech of Mr. W. M. Crowe, chairman and managing director of the British L. M. Ericsson Manufacturing Co., Ltd., reported in our City pages to-day. We still hold the opinion that little is lost by discussing the subject of industrial relations in a conciliatory spirit, but sometimes it does no harm if we substitute for smooth and persuasive utterance a plain statement of facts. We may confuse the seriousness of a situation by a mass of words—may lose the substance in grasping at the shadow—may legislate for better conditions in the present and create a legacy of want for days to come. Let us, then, get down to the facts. Mr. Crowe, as representing an industrial company which desires to take advantage of the unparalleled world-trade opportunities of the moment, is faced with a series of menacing conditions which are blocking the path of British enterprise, while competitors in other lands are not so seriously handicapped. He has summarised this series of difficulties in a way that should carry conviction. As we have again and again pointed out during the war, the stricken nations of Europe and the empty outer countries of the world must have supplies of manufactured electrical products. British prestige stands high to-day, and sentiment is in our favour, but our capacity to supply their needs and the price at which we can sell our product are matters of supreme concern to the client whose necessities are clamant. He *must* have the goods from somebody. He prefers to come to England for them if he can get them, but have them he must, and that without delay, and if we cannot meet his requirements, sentiment will be subordinated to necessity, and he will get them where he can. We have a greatly-increased works and plant capacity; have, or shall have, as more and more men come home to find work, plenty of labour; many of our manufacturers are ready to show a greater spirit of venture and enterprise than ever in the past; the raw-material situation may be getting easier shortly; but there are clouds on the horizon far bigger than a man's hand, presaging a veritable deluge of difficulty which is inducing capital to take cover rather than expend itself in the open in efforts which will secure business and provide work. Experienced men and economic students know all too well that unemployment has always been an inevitable consequence of want of confidence. In normal times a financial upheaval in one country has spread its nervous influence from land to land; there has been unemployment and a period of distress; then, after a few years, a renewal of confidence has been manifested in a fitful and venturesome sort of way in several places at once; there has been a gradual recovery, and at last we have been well on the way to revival, rising on a trade curve to a boom. It is perfectly true that the present are not normal times, and that there are new factors in

the situation—such as a crying need for manufactures which demands to be satisfied. The great question for us to-day is whether the industrial interests of Britain are going to be sacrificed because our present difficulties and discussions prevent us seizing the opportunity to meet those demands. How can a manufacturer quote firm and competitive prices or undertake to give quick deliveries when there is so much doubt overhanging all his operations? What will the taxation on industry be? What will labour cost—When will it become stable? What will be the effect of shorter hours—will there or will there not be, in a given case, increased efficiency and more economical production? What will be the profit permissible on industrial capital? Will some compulsorily imposed system of profit-sharing have to be taken into account when giving estimates? Or will additional industrial capital be found wanting because a bigger yield can be secured in less disturbed directions? What will be the international policy regarding imports and exports of manufactured goods? What will the safeguarding of key industries amount to? If the British workman takes a larger measure of leisure and pleasure and a larger wage without giving increased work, and the decrease in effort cannot be fully made up for by new methods and new machinery, where shall we be placed competitively? We are aware that any fool can ask questions, but manufacturers and others who are in a dilemma because of a series of questions which are a very babel about their ears just now, are no fools. They see that unless the present period of uncertainty can be cut short, Labour and the nation may awaken when it is too late to the fact that we have been playing into the hands of other peoples who, perfectly legitimately, are out to do business while we are engaged in discussing how burdensome a halter we can possibly carry round the neck of British industry.

To suggest that Mr. Crowe's speech should be widely circulated in labour circles might be to invite attacks on capital and its propaganda. Yet the speech is a plain statement of fact, and however ingeniously Labour may put it through the sieve, it cannot dispose of the truth that it contains—namely, that uncertainty haunts the path of the manufacturer, and prevents him engaging in a progressive Peace-time industrial activity.

We are in for a neck-and-neck race with foreign competitors. We may foolishly impose a handicap upon ourselves which will put us out of the running for the prize of world trade supremacy. The sooner we see the danger that lies that way, and settle our differences as permanently as may be, the better it will be for the entire nation. Better conditions for all can only be secured, under the present system, by ensuring the stability of industry by enabling it to be profitably conducted. It is possible for the State to stifle industry by imposing throttling taxation. It is possible for Labour to render it unattractive by repeating unreasonable demands. It is possible for Capital to perpetuate discord and cripple itself by withholding from Labour a fair share of the profits that it earns. The State needs, and must have, revenues—it stands to gain them by allowing industry the maximum of freedom for display of enterprise and the policy of development. Labour demands the right to live in better circumstances—sure of work and sure of good wages; it cannot obtain its desires permanently if it continues its prevailing policy of demanding more than competitive industry can afford. Capital may, and should, do what it can by profit division along some such lines as are indicated by Mr. Crowe and by the chairmen of some other electrical and industrial undertakings, to give those who earn its dividends a commensurate interest in those profits.

A Board of Imperial Communications.

It was announced in our columns last week that the Government had decided to appoint a Board, under the presidency of Lord Milner, to control Imperial communications. Readers of the Electrical Review will remember that in our recent notice of Mr. Charles Bright's book, "Telegraphy, Aeronautics and War," we pointed out that the book was practically an argument for a Board of Imperial Communications to be charged with the systematic development of cable and wireless telegraphy throughout the Empire. The proposed composition of the Board and its precise functions have not yet been announced. Undoubtedly there is great scope for a Board composed of practical men, and endowed with adequate powers in the most important field of Imperial electrical communications. The war and the restrictions arising from it have played havoc with rapid communication, and there is nearly five years of arrested development to make up. It is to be hoped that the Government will appoint practical men from the electrical profession to this Board. Besides Mr. Bright, whose name is known to the public through his writings, there are other telegraph engineers, doubtless unknown to the politicians, whose life work has been Imperial telegraphy.

The Reliability of Large Turbines.

That the total cost of power generation will be materially affected by the choice of sizes of generating sets, is generally admitted. A question that will probably remain unanswered to the satisfaction of all for some time to come, is: has the remarkable growth of steam turbo-generating plant in recent years been natural, or has it suffered temporarily from over-stimulation, which is destined to result in a relapse?

In any electricity supply system, the size of the individual generating set should bear some clear relation to the total load, and to its fluctuations throughout the day. On the one hand, it does not pay to put too many eggs in one basket; on the other, there is a material disadvantage in an unnecessary multiplicity of sets. The fundamental consideration is that there should be enough reserve plant in a system to ensure that no contingency reasonably to be expected can seriously interfere with the output, so far as the generating stations are concerned.

Some interesting information relative to the reliability of large turbines was given in a recent article in the *Electrical World*. In so far as conditions affected by the design of plants are concerned, it is appreciated that in sizes up to at least 30,000 kw. rating, higher efficiency at the same cost per kilowatt is obtainable purely by reason of the larger size, and still higher efficiency for a slight increase in cost per kilowatt, and it has been demonstrated that as high a degree of reliability is obtainable in the larger units as in the smaller ones.

It is given as the opinion of the engineer of the turbine department of an American manufacturing company that large units are commercially practicable up to limits not yet reached. He maintains that increase of size need not impair reliability, while it may improve efficiency. To demonstrate that any difficulties experienced can be corrected after proper analysis of the trouble, he refers to installations of large sets furnished by his company.

Up to the present time that company has built 14 large units, ranging in capacity from 30,000 kw. to 70,000 kw. Of these, 11 have been shipped, 10 are in service, and 7 have been in service for one to five years. Of the 30,000-kw. sets in service, all of which are of the pure reaction type, one is a tandem-compound machine, direct-coupled to a single generator; two are of the single-cylinder and three of the double-cylinder type. Two cross-compound sets are rated at 40,000 kw. and 45,000 kw. respectively, whilst the largest unit, of 70,000-kw. capacity, is a three-cylinder cross-compound machine.

Whilst the records of these units do not all show 100 per cent. perfection, they do show that in not one instance has there been any evidence of inherent or basic defects in

design or difficulties in construction or operation. Some troubles have been experienced, but these have all been of minor character, due to avoidable defects in details such as are experienced with new designs of any size or sort. It is significant that with one exception (the high-pressure rotor of the 40,000-KW. set was returned to the shops for checking for truth and reblading) no important part of any of these sets has ever been returned to the works for any reason. Whilst most of them have not been subjected to any accurate steam-consumption tests, definite reductions in station coal-consumption rates were effected by their installation.

This performance should speak for itself, and, in conjunction with the report of a Sub-Committee of the "Union of Electrical Syndicates," which has, according to the *Revue Générale de l'Electricité*, reported on the means for restricting accidents to turbo-generators, should throw light on this most important problem, and afford valuable guidance in the developments which are about to take place in this country.

The Divisional Engineers.

The official statement, reproduced on another page, recording the formation, misapplication, and dissolution of the Divisional Engineers of the Royal Naval Division is a melancholy story—a record of splendid abilities and patriotic ardour wasted and frittered away, at a time when the nation's need for such qualities was imperative and insatiable. It is, unfortunately, only one of many examples of official inability to appreciate the value of the technical knowledge and experience of professional engineers, which were freely offered to the nation, accepted, and treated as of no account. Just as a blockhead might use a razor to pull up tacks, so ignorance condemned these men, whose speciality was brains, to manual labour which would have been better done by navvies. Even when, owing to improper use and the lack of adequate organisation, the remnants of the unit had to be absorbed in the Royal Engineers, their seniority was washed out, and they were regarded as recruits—after two years' arduous service!—and they were still employed on unskilled work. That was not because there was a surplus of technical men—quite the contrary; it is notorious that many commissions were granted to men who had no claim to the possession of engineering qualifications, and who, consequently, were dependent on their subordinates for guidance and instruction in the performance of their duties. The whole affair reveals a degree of ignorance regarding the meaning of the term "engineer" which is simply appalling, and the imperative necessity for engineers to assert themselves and to secure due recognition, not only in the public eye, but also before the law, is obvious. We hesitate to accept the theory which has often been pressed upon us, that those who were entrusted with the duty of appraising men in terms of their ability, took care that expert engineers should not be given commissions if it could be avoided, lest their own shortcomings should be revealed by the superior abilities of their subordinates—but if this theory is discredited, the only alternative is to ascribe the ghastly mistakes that were made to blank ignorance. It is quite inconceivable that any competent and impartial engineer officer, charged with the choice of men to fill responsible engineering posts, could possibly pass over duly accredited engineers in favour of non-technical men—it is incredible. We trust that employers engaged in reorganising or extending their works will give special heed to the claim justly advanced on behalf of these ex-members of the Divisional Engineers—that they ought to have the first chance.

The Transport Bill.

The speech delivered by Sir Eric Geddes in the House of Commons, on Monday last, in recommending the Transport Bill to the members for second reading, confirmed the intention of the Government to proceed at once with the electrification of our main-line railways, but contained no suggestion that the Government was willing to remove the National Electricity Supply Scheme from the control of the new Ministry. That there exists no country where the railway conditions offer a more attractive field for electrification than this, we have maintained before, and we see no reason to modify our views; nowhere else in the world will be found such dense traffic, such a network of railways, such a demand for expediting the handling of trains and increasing the carrying capacity of the system, as here. But what are the arguments in favour of putting the supply of electricity under the control of the Railway Minister? Sir Eric claims that when the railways are electrified, fully 20 per cent. of the electricity of the country can be used for traction; but 50 per cent. will be used for industrial purposes—and if the biggest consumer is entitled to have control of the supply, it will not be the railway interests that will establish the best claim to that privilege. He went on to argue that it was in the interests of the railways to develop the resources and industries of the districts which they served, and that it would obviously be to their interests to develop the industrial use of electricity, just as in the past certain railways have assisted in the development of agriculture and poultry farming in order to augment the traffic on their lines—but Sir Eric did not add that those railways had felt it necessary to that end to keep hens. It will not do. The arguments in favour of his scheme of annexation are as thin as they are fallacious. He points to the prosperity of the North-Eastern counties as proof of the advantages of co-operation between the railway company and the electricity supply authorities—*co-operation*, be it noted, *not combination*. We are amazed that such feeble reasons should be seriously put forward to justify a course which not only offers no genuine advantages, but is bitterly opposed by the public bodies concerned (except those which stand to profit by it—namely, the railway companies), and we can hardly believe that this extraordinary proposal will find acceptance at the hands of Parliament.

I.E.E. Proceedings.

The activities of the Institution show no signs of slackening; this week no fewer than four meetings are taking place in London alone, three of which are open to all the members, and the February issue of the *Journal* contains several pages of "Institution Notes," showing that various important movements are in progress. Amongst the latter are included the organisation of sectional meetings for the reading and discussion of papers on Wireless Telegraphy, and the formation of a Society of Radiographers, while the labours of the electrical standardising committees of the British Engineering Standards Association, which consist mainly of members of the Institution, are as valuable to the industry as they must be exacting to the personnel. The week was marked by the inauguration of the "informal meetings" on Monday last, and we are pleased to record that the new departure was successful from the start; the hall was well filled, and evidently the accommodation will prove inadequate in the future. The paper, by Mr. Pooley, was thoughtful and suggestive, and the discussion was both well maintained and interesting—in some respects exceptionally so, though, in compliance with the principle which is to rule these proceedings, we forbear to enter into details.

We may, however, venture to offer the managing Committee a few suggestions, based not only upon our own observations, but also upon remarks that were volunteered to us by other members who were present, with a view to promoting the efficiency of the meetings and enhancing their popularity. In the first place, the hour of opening is rather late; we suggest that it be altered to 6.30 p.m. Again, the adjournment for refreshments in the middle of the meeting is of doubtful advantage; it interrupts the proceedings and introduces delay, without compensating benefits, and if the present practice of the Institution's ordinary meetings were followed, the refreshments being "on" from 6 to 6.30, we believe the change would be welcomed. Lastly, as the main object of the meetings is discussion, the opening paper should be confined to half-an-hour at the outside, leaving one, or one and-a-half hours, for debate before closing at 8 or 8.30. We believe that if these points were put to the vote by the chairman at the next meeting, the verdict would be strongly in their favour.

COMMISSIONING ALTERNATORS.

By C. W. MARSHALL.

When new alternators are being put into commission, it is the general practice to leave all the preparations in the hands of a representative of the makers. The procedure followed by different firms varies greatly in detail, but the broad outlines may be gathered from the following notes, which deal with the electrical part of the problem :—

Drying-out.—After erection, the first stage of preparation for service is the drying-out of the stator and rotor windings. Most British firms dry-out by circulating low-pressure current through the windings. The condition of the insulation is determined from time to time by measuring the insulation resistance, and as a safeguard against excessive local temperatures, thermometers are placed in contact with the coils. Continental firms do not generally dry-out by the above method, as they contend that the heating is initially almost solely confined to the copper. This tends to cause self-stressing in the windings, and may injure the insulation. To avoid this, they dry-out by running the alternator first unexcited, then with gradually-increasing excitation until the desired insulation resistance is attained.

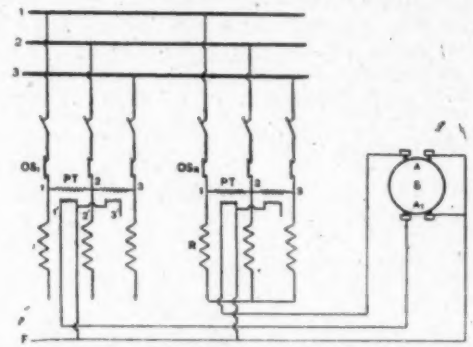
Manufacturers are not yet unanimous as to the value of the insulation resistance at which the drying-out may be said to be complete. The British Engineering Standards Association gives some general rules which may be taken as a guide on this matter, but care should be taken to consult the makers of any machine which is being put into service if any responsibility is to lie with them. The most important point cited by the above Association (Report 72, 1917) is that the insulation resistance in megohms shall be not less than—

Rated pressure (volts) ÷ (1,000 + rated output (K.V.A.).)

For a 6,600-volt, 6,000-K.V.A. machine this formula gives 0·9 megohm, and there is a special note regarding the dangers of trying to obtain high values, as the insulation may be permanently damaged in the process. This point is now generally accepted, but at least one important firm insists on 40 megohms as a minimum. The writer's experience of machines of this make tends to confirm the views of the Standards Association, as samples of insulating material taken from damaged machines which had been subjected to rigorous drying out were found to be extremely brittle and defective mechanically.

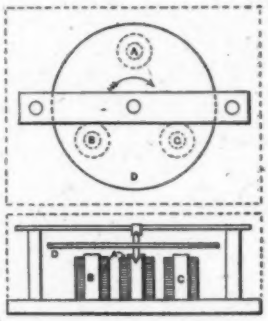
Pressure Tests.—The rules given by the Standards Association for pressure testing are fairly definite, and should be followed as closely as possible. The R.M.S. value of the test pressure (applied to the stator windings) should be twice the rated pressure + 1,000 volts. This pressure should be applied gradually, and then maintained for one minute. Any frequency between 25 and 100 cycles/sec. may be employed. The insulation between phases and to frame (earth) may be completely tested by two tests, phases 1 and 2 to 3 and earth, then phases 2 and 3 to 1 and earth. Subsidiary pressure tests are carried out on the rotor and the exciter. In these cases the test pressure should be ten times the rated excitation pressure, with minimum and maximum values of 1,500 and 3,500 volts. Two points of practical importance not mentioned in Report 72 are the K.V.A. capacity of the testing transformer, and the use of spark-gaps to prevent the application of excessive pressure to the machine undergoing test. Regarding the former point, it may be mentioned that the Admiralty specifications give 5 K.V.A. as the minimum size of pressure-testing transformer to be used on their apparatus. The reason for using a large testing transformer is that many machines take a considerable charging current, which may give rise to peaky potential wave form. Hence the R.M.S. value of the test pressure recorded by an ordinary voltmeter may give a very inadequate idea of the maximum stress to which the insulation is subjected. The capacity of the stator winding of a 6,000-K.V.A., 6,600-volt, three-phase, 1,500-R.P.M. alternator stator winding is about ·5 microfarad. The charging current for such machines at the standard test pressure (14,200 volts) would be about 2 amperes at 50 cycles/sec. The K.V.A. load on the test transformer, if all three phases were tested simultaneously to earth, would be 30 K.V.A.

British manufacturers disagree as to whether spark gaps should be employed or not. Several firms will not allow a gap to be used at all, as they fear the possibility of surges arising in the event of the gap coming into action and setting up an arc in a resonant circuit. On the other hand, one large company insists on a needle gap being coupled up in parallel with the circuit under test. The writer inclines to the opinion that a spark gap should only be used if the testing transformer is capable of subjecting the machine under test to a pressure greatly in excess of the required testing voltage.



1, incoming alternator; 2, running alternator; PT, potential transformer; S, synchroscope; OS, oil switch.

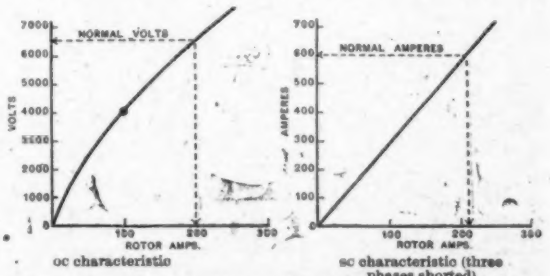
Fig. 1.—Connections for Synchronising Test.



A, B, C, bobbins with iron cores, with windings star connected; D, disk (copper or iron).

Fig. 2.—Phase Rotation Meter.

Verification of Paralleling Instruments.—As it is necessary to open up the alternator neutral point connections for pressure testing, it is convenient to verify the synchronising gear immediately after this test. The method of doing this is to switch the new machine on to the live bars with its neutral point open, and so excite both coils of the synchroscope from one source. Under these conditions the synchroscope pointer should come to its normal paralleling position. Fig. 1 shows the principal connections in this test.



OC characteristic

SC characteristic (three phases shorted).

Resistance of stator windings = 0·023 ohm.

Fig. 3.—Verification of Characteristics.

The only error likely to occur in these connections is a cross on the leads from the potential transformer secondary of the incoming machine. This would be indicated at once by the synchroscope reading 180 electrical degrees out of phase (A'). Should the pointer indicate 120° from A, the potential supply to the synchroscope has been taken from the wrong phase, but this mistake is not likely to occur with anything approaching intelligent supervision. The ratios and polarities of all potential transformers for the new machine should be verified at this stage. No mention is made of paralleling devices, such as voltmeters or lamps, as these are assumed to be obsolete; the application of the method outlined above to any of these is, however, quite obvious.

Phase Sequence.—The only other point which requires verification before the machine is put in parallel with existing plant, is its phase sequence. This can be done, in some instances, by running an existing motor by means of the new machine, and noting whether its direction of rotation is normal or reversed. It may, however, happen that this method cannot be adopted, and a phase-rotation meter must be employed in conjunction with the alternator potential transformers. The procedure in this case is to connect the phase-rotation meter to 1', 2', 3' (fig. 1), and note the direction of rotation of its disk (*a*) when the potential transformers of Machine I are supplied from the bus-bars, as in fig. 1, and (*b*) when supplied by Machine I itself. In this case, OS, is, of course, open, and the neutral point of the machine is connected up. If the direction of rotation is the same in both cases, the alternator may be paralleled in safety. It may be noted that a phase-rotation meter is only a small three-phase induction motor working with about 0·1 ampere. One form of this instrument is shown in fig. 2.

In the event of the direction of the rotation of the new machine being reversed, it is necessary to reverse any two of its outgoing leads. Such an error should not arise, as it is easy to predetermine the phase sequence of an alternator from a winding diagram or the machine itself.

The alternator is now ready for going on load, but it is well worth while to make the following auxiliary tests before starting it off on its regular work :—

(*a*) Verify the open- and short-circuit characteristics.

(*b*) Test the operating current of the protective gear under artificial fault conditions, and the degree of balance obtained under normal working conditions.

The foregoing tests are summarised in the following table, and are illustrated by an example taken from practice :—

No. 6 Alternator, "A" Station.

(6,600 volts, 1,500 r.p.m., 25 ~, 6,000 k.v.a.)

Programme and results of tests, &c., before going on load :—

(*a*) *Drying Out.*—Method, direct current passed through stator phases connected in series. Current maintained at 250 amperes for 20 hours.

Initial insulation resistance	<	50,000 ohms, stator.
	<	„ „ rotor.
Final „ „		10 megohms, stator.
		1 „ rotor.

(*b*) *Pressure Test.*

Circuit.	Test pressure.	Capacity current.	Time of application.	Remarks.
Stator phases, 1, 2 and 3 to frame (*e*)	14,000 v.	0·36 a.	1 min.	Very heavy "static" discharge from windings during test.
1 and 2 to 3 and earth	„	0·24 a.	„	—
2 and 3 to 1 and earth	„	0·24 a.	„	—
Rotor winding to frame	500 v., D.C.	—	„	No facilities for making more rigorous test.

(*c*) *Synchroscope Connections.*—The alternator was switched on to the bus-bars with its neutral point open. The synchroscope read 180° from correct position. This was corrected by reversing the leads from the synchronising transformer.

(*d*) *Phase Rotation.*—The same direction of rotation was obtained on an induction motor when run by existing plant and then by the new alternator.

(*e*) *Subsidiary Tests.*—(i) Open- and short-circuit characteristics were verified, and are reproduced in fig. 3.

(ii) Verification of Protective Gear. (Merz-Price circulating-current system, with high-impedance relays.)

(*a*) Fault conditions (short between phases).

Relay operated when fault current reached 60 amperes, *i.e.*, approximately 10 per cent. of full load.

(*b*) Balance.

With normal full-load current in the alternator (600A.) the current in the relay circuits was less than 1 milliampere. When the relays were short-circuited to reduce the resistance in the circuit, the current rose to 3 milliamperes.

The machine was then paralleled on to the bus-bars and gradually loaded, until at the end of two hours it had reached its normal full-load capacity.

ELECTRICAL DEVELOPMENT IN CATALONIA.

[from our special correspondent in spain.]

Catalonia is the Lancashire of Spain, and its capital—Barcelona—has the characteristics of Liverpool, Manchester, and Birmingham combined. Industrially, it is the most developed Province in Spain, and is, therefore, the leader in the Regionalist or Home Rule movement, which is now distracting the politics of the country. For the same reason, it is the centre of Trade Unionism and syndicalist activities. There is also a strong Republican party. All these elements, working singly and in combination, have made Catalonia the danger spot of Spain, and it is probable that if the Province had undergone the severe inconveniences and privations suffered in other parts of the country (due chiefly to the lack of coal), the history of the whole of the Peninsula during the past four years would have been very different. At the present time it looks as if the good Catalans have almost lost patience. They have gone on strike as a protest against high prices and against Government by the effete and old-fashioned rest of Spain.

The reason why the prevailing lack of coal has not been so acutely felt in Catalonia is that this Province is very rich in water power, and some very large hydro-electric plants have now been in operation for some years. The following table gives some idea of the existing installations and the possible development :—

Water Power in Catalonia.

Owned by—	H.P. installed.	H.P. in construction.	H.P. in reserve.	Total H.P.
Riegos y Fuerzas del Ebro	96,500	60,000	185,000	341,500
Energia Electrica de Cataluna	42,000	20,000	145,000	207,000
Cataluna de Gas y Electricidad ...	12,000	24,000	200,000	236,000
Sociedad Productora de Fuerzas Motrices ...	—	24,000	40,000	64,000
Other ownerships ...	—	—	256,460	256,460
Totals	150,500	128,000	826,460	1,104,960

Thus, 13·5 per cent. of the total power available is already installed, and 11·5 per cent. is still under construction, leaving 75 per cent. not yet touched.

The Riegos y Fuerzas del Ebro, together with its sister company, the Barcelona Traction Light and Power Co., has its registered office in Toronto, Canada, and was founded by the late Dr. Pearson. The capital of the two undertakings is $35,000,000. Energy is transmitted at 110,000 volts over a distance of 183 km. from some of the outlying power stations. The Energia Electrica de Cataluna was founded in 1911 by Emilio Riu, financed by French and Swiss capitalists to the extent of 50,000,000 fr. The "Canadiense" and the "Cataluna" have a working agreement in the industrial zone of Barcelona and Mataro, and lend mutual aid when required.

All the great enterprises were busy making extensions when the European War broke out. The "Canadiense," for example, was preparing to devote 75,000 H.P. to chemical purposes, including 25,000 H.P. for the production of nitrates. The war stopped these developments, and, up to the present, the cessation of hostilities has had very little effect in the direction of stimulating the development of industry, either in Catalonia or in the rest of Spain. On the contrary, it appears that there are troublous times ahead for the whole of the Peninsula. When things have settled down again an influx of American capital may be expected—the deep interest taken in the United States in the proposed new trans-Spanish railway and in the proposals to develop the port of Vigo is indicative of this. Also, it is not absolutely absurd to imagine that Catalonia may one day find herself a province of republican and democratic France. In either case, Great Britain is likely to be left out in the cold.

NATIONALISATION v. PRIVATE ENTERPRISE.

By GEO. H. HOOLE.

It is, unfortunately, true that what the daily Press says to-day is accepted by the nation to-morrow; and it is also a fact that the greatest difficulty is experienced in forcing the English people to think for themselves and not only of themselves.

"Nationalisation" is developing into a parrot cry; and unless some definite facts for and against nationalisation are brought to the notice of the people, there is a real danger that there will be nationalisation—in the ordinary acceptance of the word—of many industries within the next few years.

It is essential, first of all, to ascertain what are the causes giving rise to the insistent call for nationalisation. The root causes are:—

1. *The people's desire to be protected against exploitation.*

2. *Their natural demand—the result of years of drudgery—to be, at least in a minor way, their own masters and not workers for dividends.*

3. *The opinion held by the working people—i.e., by the masses—that nationalisation will result in a more equal distribution of wealth, an opinion fostered by the propaganda of a section whose enthusiasm exceeds its discretion.*

4. *The people's need of State protection which would ensure security of employment, better wages, and improved conditions.*

The demands are due to a semi-conscious desire to return to the early days when the earth belonged to the people who conquered it.

At the present time the people are experiencing the intoxication of power—a power gained in consequence of the policy adopted during the war, the policy of the Government rightfully recognising that it is the "common" people who comprise the majority of the nation, and conquest rests with the majority.

Right only conquers because ultimately the majority is on her side; up to the time when America entered the war, might was horribly victorious.

Now, in a democratic country, the conquerors are the majority—*i.e.*, the "masses"—and unless the people's "might" is guided by right motives, and the people are made fully cognisant of what will be the result of their actions, there is the grave danger of "might" being victorious to the detriment of what is "right" to themselves and to the nation as a whole.

The four root causes enumerated are legitimate growths, and must be recognised and taken fully into account.

Each one is genuine, and each root has to be removed out of the national consciousness of the people before national security, in the broadest understanding of the word, is reached. The people are demanding that the removal be carried out by adopting nationalisation, believing that that proposal is the only effective method. By nationalisation they mean the *full* control by the State of industry—*i.e.*, that the State buy out the present owners, and take over the buildings, plant, and staff, and work the concerns for the benefit of the people.

It is suicidal to ignore these root causes, for by so doing the growth will become vigorous, and require more labour to uproot at a later date. The wiser course to follow is to cultivate the growth so that it will take an orderly direction leading to industrial peace.

To take each of the four causes enumerated:—

1. *The People's Desire to be Protected against Exploitation.*—Nationalisation would certainly remove the cause of this grievance—*i.e.*, the profiteer; but it would not bring about the reduction in prices which the masses would ordinarily expect. On examination it will be found that:—

The excess price of the article over actual cost of production would not be in direct proportion to the cost of the "protection" sought by the people, but much in advance of that cost consequent upon the necessity of employing a much larger *unproductive* staff to deal with industry under Government administration. I say "necessity" advisedly, as this "unproductive" staff is a real necessity in any Government Department responsible for its doings to any Party Government.

2. *The Worker's Desire to be his Own Master.*—There never was a greater fallacy than to imagine that employment under the Government gives a man greater freedom.

It must be recognised that foremen and controllers, directors—call them what you will—are necessary in all concerns, and the bigger the concern, the greater number there are above the ordinary workmen. By nationalisation, automatically the whole of an industry becomes equivalent to one firm controlling the industry, with the important difference that were one firm to control the industry, the number of persons in positions of authority would be much less than the number under nationalisation, and that fact is due to—

1. Responsibility to the country, necessitating, as nearly as is practicable, a thief-proof and fool-proof system.

2. The necessary consultation with other Government Departments, to ensure uniformity of general policy.

3. The setting up of separate departments, which in industry under private ownership are controlled, along with other departments, but which under nationalisation would become too large to be dealt with in that manner.

4. The compilation of statistics required for the information of the House of Commons—the representative body of the people, and the actual controllers of the industry.

1 and 4. *More Equal Distribution of Wealth and Better Conditions.*—By nationalisation of industries there would certainly be better wages and better conditions, but those advantages could be obtained more economically, and to a far greater extent, by the proper organisation of private industry than by nationalisation. If in industries there were—

1. A fair and reasonable limitation of profits, the limit for each industry to be fixed by the State, after conference with the masters and men.

2. A working understanding between the heads of industry and the body of the industry.

3. A fuller and more genuine recognition of the fact that each is a unit of the whole, and that unless all work together for the good of the industry, and of the nation, disaster to both must result.

Nationalisation is in direct opposition to the natural desire of the people, and is the outcome of an unnatural outlook upon life.

If the policy of nationalisation, as it is understood to-day, were adopted, it would cut out competition; healthy, legitimate competition between one body of men, *i.e.*, Capitalists and Labour, working under proper conditions and for legitimate remuneration, and another such body of men.

Take away competition, and you take the heart out of life; you shut down enthusiasm and damp ambition.

It is English to desire to beat the other man, to wish to be the winner, and this spirit is evident in the whole of an Englishman's life.

Further, under nationalisation the most remunerative posts would be given to those who had passed difficult

examinations, for which only college trained men could hope to enter, and the rise of anyone without college training would then be impossible, a most un-English state of affairs. The system would make more evident the "class" difficulty, a difficulty which at the present time is nearer solution than it has ever been in the history of the world.

In private industry, initiative, discretion, ambition, and pluck—each one an English characteristic—are essentials, but in nationalisation caution and safety must take precedence, the responsibility being to the country!

Any industry to be successful—and a successful nation is a combine of successful industries—must take account of *all* the people employed in that industry. Those with initiative, energy, enthusiasm, must in the natural course of events rise to positions where their special qualities will further the advancement of the industry; again, those with manipulative abilities must occupy their responsible posts in the industry. In other words, *in private enterprise each man, to a great extent, finds the level he is most suited for, whilst under nationalisation the level is made for him.* In private enterprise there is every avenue open to the working man who has energy, enthusiasm, and initiative; whilst under nationalisation, there is practically only one accessible path, and that one is so long, so narrow, so hedged in and so horribly uninteresting that it is almost impossible for such a man ever to reach the end of it, or to pass from it to a broader and pleasanter highway, where he has room to expand and display his abilities.

As a nation we have a high position to maintain—the position of leader to the whole civilised world, the *rôle* of exponent of the "might" of "right." To maintain that position, each Englishman must give of his best; but nationalisation takes away most of the admirable characteristics attributed to Englishmen. Let us live in the open. Let us be free. There is room for all. Let the people have their proper share of the profits and in the management of industry, and their grievances will disappear; refuse them that share, and there is no power which will prevent them breaking down the barriers which prevent them from expansion.

They have seen beyond the broad fields of a fuller life, and, having seen, desire. The power to grant that desire is with those already in the broader fields of life.

THE "DEX" OIL COOLER.

The important part that efficient cooling of the large quantities of oil employed plays in modern power-station installations has compelled much careful consideration to be given to the problem by the engineers responsible for such installations. In this connection, the following particulars of the "Dex" oil cooler (Harrison's patent), which is being

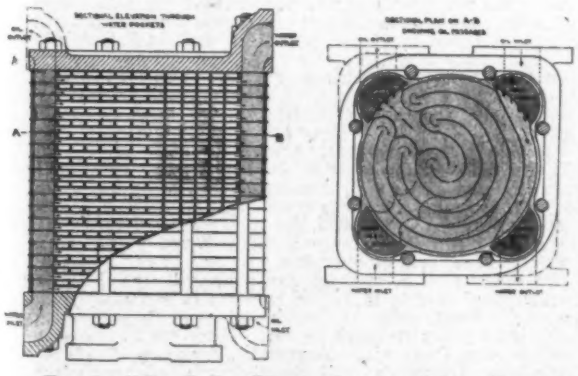


Fig. 1.—"Dex" Oil Cooler, Showing Ribbed Plate on the Right.

manufactured by Messrs. W. H. De Ritter & Co., Ltd., of London, will be of interest.

The construction, as seen from fig. 1, consists of bolting up between strong end covers a series of die-cast plates arranged alternately with rolled metal plates. The cast plates are provided with ribs and flanges on both sides, so that when bolted up a series of passages are formed between the plates through which the oil and water are circulated. The four holes in the corners of the plates form pockets running the whole depth of the plates, and terminating in the oil and water connections on the end covers. The oil and water enter the cooler by their respective connections on the bottom cover, pass to their respective pockets, and, through slots cut in the flanges surrounding the latter, are delivered to the passages between the plates. After circulating through alternate passages in opposite directions the two liquids are delivered in turn to their respective outlet pockets and connections on the top cover.

The passages are rectangular and shallow, thus exposing a large cooling surface to the fluids passing through. A further point is that there are no dead spaces where either fluid can remain stationary, thus preventing the transfer of

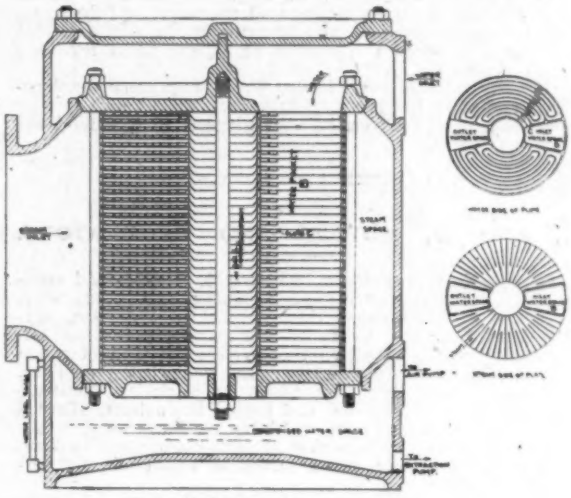


Fig. 2.—"Dex" Condenser.

heat, or where air can collect; any air bubbles which might be formed would be driven forward by the positive flow of the fluids and carried away.

The only possible leakage of one fluid into the other is at the pockets; the length of joint here exposed is, however, very short. Any other leakage would be visible. The ribbed plates are die cast and then ground on both faces. It is claimed that when this work is carefully carried out in the proper manner perfect joints are the result, and that the effect of any expansion of the plates, due to warming up

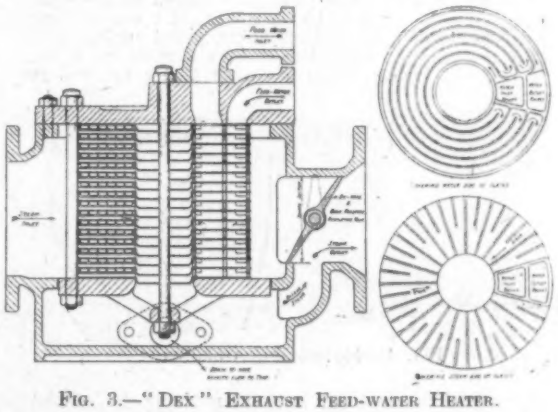


Fig. 3.—"Dex" Exhaust Feed-water Heater.

when in operation, would be to increase the pressure on the joints. Normally the oil and water passages are in parallel, but by introducing baffles in the pockets the parallel may be changed to the series system of working, with two, three, or more flows, thus increasing the cooling area.

The passages for the fluids give a high heat transmission efficiency without undue friction, and from tests carried out by the manufacturers it was found that a transmission factor of 270 B.Th.U. per 1 deg. F. per sq. ft. was obtained for a drop of 15 lb. pressure between the inlet and outlet connections. Moreover, it appeared that this transmission factor varied in direct proportion to the velocity of the oil, and that the velocity was nearly proportional to the pressure.

It is claimed that the space occupied by this cooler is only 10 per cent. of that required by a tubular oil cooler of equal capacity, and a further advantage is that additional surface can be obtained by simply increasing the number of plates, requiring only bolts of increased length. For large installations a number of standard units would be built up in multiple, this arrangement having the advantage that the whole battery need not be shut down at any time, it being prac-

D

ticable to cut out one unit at a time for cleaning or repair purposes.

The "Dex" principle of heat transmission is adaptable to various other uses in which it is desired to transmit heat between fluids, either for heating or cooling, such as air coolers, feed-water heaters, condensers, &c. The latter have been tested on a small scale and show a very high efficiency. It will be noted (fig. 2) that in the condenser the plates are assembled between two headers forming an independent unit which is dropped into its seat in the casing. It is therefore a very simple matter to drop in a spare set of clean plates while the set taken out is being attended to at leisure.

The condensers would be built up in multiple in a similar manner to that arranged for the larger oil coolers. The outer casing would, however, embrace all the units, and the steam and water connections would be made on the casing so that no pipe joints would require to be broken when removing a set of plates.

The exhaust feed-water heater (fig. 3) requires no explanation, except to point out that the bolting is much heavier than that of the oil cooler or condenser, to withstand the higher pressure.

L. AND W. MOTORS AND GENERATORS.

The field of application for light-weight, portable and semi-portable, self-contained electric generating sets is very wide. Recently we had brought to our notice, at Willesden, during a visit to the works of Messrs. Arthur Lyon and Wrench, Ltd., some such sets, the electrical parts of which appear to be designed on efficient and somewhat novel lines. The inspection of the works, which are of modern construction, spacious, well lighted and heated throughout, afforded considerable interest; the comforts of the employés are looked after by the provision of a well-equipped canteen, to the quality of the meals served in which we can personally testify.

Besides the generating sets referred to, the firm also manufactures apparatus for the projection of light, such as searchlights, signalling lamps, &c., considerable numbers of which have been supplied to the Forces. During the war the firm has been actively engaged upon the production of munitions of war, and at present it is in course of changing over from war- to peace-time production.

The L. & W. petrol-electric sets are made in a range of sizes with outputs of from 0.5 kw. upwards, the 2.5-kw. set complete weighing about 155 lb. The semi-portable set consists of a two-cylinder vertical type engine, coupled to a 4-kw. dynamo, the set being entirely self-contained and weighing about 6 cwt. complete. For portability, detachable carrying-poles are supplied, and the equipment can also be fitted on trucks, which latter can be propelled by the engine through a special clutch. The set consists of a well-balanced, horizontally-opposed, 2-cylinder, 4-cycle, petrol engine, direct coupled to a 4-pole, special light-weight dynamo fitted with a cooling fan, which draws a stream of air through the

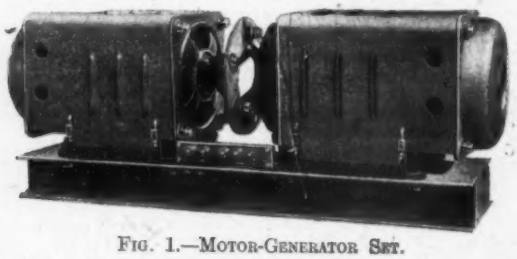


Fig. 1.—Motor-Generator Set.

dynamo, and then circulates it round and over the cylinders of the engine with such cooling effect that, it is claimed, the engine will run continuously on full-load ratings. The materials are of high quality, while all moving parts are fitted throughout with roller and ball bearings, and with automatic lubrication.

Referring to our illustrations, fig. 1 shows a motor-generator set comprising a L. & W. motor and dynamo of the protected type, mounted and coupled by a flexible coupling. Fig. 2 illustrates a drip-proof motor, while fig. 3 gives an idea of the motor without the enclosure, and showing method of frame construction, as well as the detachable brushgear as a self-contained unit.

These machines are specially designed to save weight by scientific proportioning of materials, and are exceptionally small in size. The workmanship is of a high standard, all parts being made to limit gauges and viewed between successive manufacturing operations. The frames of these machines are of light and rigid construction, being built up of steel rods attached to cast end brackets. The field magnets are of laminated construction; they are built up of stampings so arranged that there are no mechanical joints whatever in the magnetic circuit, and practically the whole of the stampings provide a path for useful flux. Former-wound coils are employed in the armature with mica insulation to Admiralty requirements.

The brushgear is of patented construction, and arranged to be withdrawn, by unscrewing four simple screws, complete with the rocker arm, as a self-contained unit, without

Fig. 2.—Drip-proof Motor.

disturbing the connections or end brackets. By the suitable design of the field magnets, perfect commutation, it is claimed, is ensured at all loads without interpoles.

Ball bearing are standardised on all machines, while a ventilating system provides for the circulation of air through

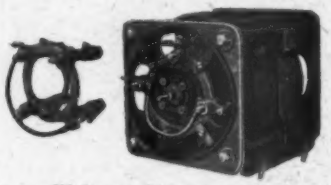


Fig. 3.—Motor Without Enclosure, showing Detachable Brushgear.

the commutator and armature, and extending through ducts in the poles and yoke of the machine. If necessary compound windings can be arranged for falling, level, or rising characteristics as required. Sliding base plates are standardised for each size of machine, and starters are provided from stock suitable for standard motors.

We are indebted to Mr. Arthur Lyon for permission to publish the above particulars, and to the departmental managers for affording facilities to obtain the same.

ELECTRICITY SUPPLY IN SOUTH YORKSHIRE

The economic possibilities of a comprehensive scheme which would, by means of one inter-connected system, supply Sheffield together with the whole South Yorkshire Coalfield and the North Lincolnshire Ironfield—an area covering roughly 1,200 square miles—with electricity, are reviewed in a report prepared by Sir John Snell and Mr. C. H. Merz. The report points out that the present position of electricity supply in the area is not satisfactory; the average size of plant in use is too small to allow of really economical generation, while the growth during the last five years has been very large. At present the total maximum demand is about 250,000 kw., and it is estimated that the total load will eventually grow to a figure of not less than 680,000 kw., and probably 750,000 kw., which latter figure is equivalent to a generating-plant capacity of over 1,000,000 h.p.

In Sheffield the load has grown in four years about 380 per cent., and the city electrical engineer estimates that the present load will be nearly trebled five years hence.

The waste energy available in the district, from coke ovens, exhaust steam and blastfurnace gas, is an important item of which full advantage could be taken were a central generating station established, for it is estimated that from this source a continuous output of 60,000 kw. would result during the first year of operation.

The question of a site for the suggested central power plant appears at first to be a very complex problem, but a site on the Trent, either at Keadby Bridge or Gainsborough, is the right policy at which to aim. There are five possible sites on the Don, viz., Neepsend, Blackburn Meadows, Rotherham, Thrybergh, and Sprotborough, of which the first three have already been appropriated by Sheffield and Rotherham.

Estimates show that a great economy of coal and in the cost of energy to the consumer would be attained from the concentration of all main generation in plant situated on the Trent, as against a chain of stations on the Don, though the cost of transmission is necessarily higher in the former case. The condensing water facilities on the Don are strictly limited in the summer months, and stations of the size required can only be worked with the aid of large batteries of cooling towers.

It is suggested, therefore, that arrangements should be made to write off as soon as possible sufficient of the capital sunk in the three stations, Neepsend, Blackburn Meadows, and Rotherham, to allow of their being treated as auxiliary or stand-by stations.

The main generating plant on the Trent would be all coal-fired, and what is particularly important from the Sheffield point of view, a saving of some 350,000 tons of coal annually could have been brought about in 1923 by this policy, had it not been necessary to keep the Don stations working on normal load.

Thus generation—other than generation from waste heat—should be effected mainly by large plant situated on the large tidal rivers, and generation from coal-fired stations situated in the denser areas where water is deficient should eventually be reduced to a minimum.

The report shows that by adopting this system of generation, electrical energy could be supplied at minimum prices, while at the same time providing a reasonable and sound return on the capital expenditure involved.

A three-phase E.H.T. primary transmission system operated at 50 cycles per second, at a pressure of not less than 33,000 volts, should be laid down on standard lines over the area (though these need not be standardised for all time) to supply distribution networks operated at a standard pressure of 10,000 to 11,000 volts, which would be laid out and so designed that they could eventually be linked up into one general system.

To meet the estimated load in 1923, new capital of from £11,000,000 to £12,000,000 will be required. With coal at 15s. to 16s. a ton, the report estimates that high-tension A.C. energy at 11,000 volts could be delivered remuneratively to consumers at an average cost of 0.394d. per unit.

The area should certainly not be reduced, and advantages would be gained by extending it. It is of prime importance that this district should adopt such a general policy and lay-out of plant as will eventually secure the lowest fuel cost.

The practicability of the policy recommended depends upon all parties concerned agreeing to proceed as rapidly as possible with the scheme, as delay would mean that some other method would have to be taken to deal with immediate increase of load.

THE DIVISIONAL ENGINEERS OF THE ROYAL NAVAL DIVISION.

The Royal Naval Division was composed originally of the men who came forward from motives of patriotism and enthusiasm. In September, 1914, the Army recruiting machinery had completely broken down, the formation of special battalions was discouraged, the Royal Engineers, the Royal Engineers (Territorial) Electrical Engineers, and other regiments were declared to be "full" with waiting lists of several hundreds. The creation of the Divisional Engineers of the Royal Naval Division opened a door for technical men, and it appeared at that time that their experience in all kinds of engineering would be appreciated and utilised. It is true that if there had been less enthusiasm, and if they had waited, most of these men would have done better for themselves.

Arrangements were at once made by the Institution of Electrical Engineers, assisted by the Institutions of Civil and of Mechanical Engineers, to recruit this unit, and the body of men sent to camp in a few days was remarkable no less for its technical ability than for its eagerness to enlist. As soon as they sailed for the Mediterranean the parent institutions necessarily lost touch with them.

A committee of the Institution of Electrical Engineers has been appointed to make inquiries about the subsequent history of the Divisional Engineers, and has found that during the Gallipoli campaign the section was employed in such work as digging wells and building a jetty; it dwindled owing to casualties, transfers, and promotions, and as there was no precedent for the Royal Naval Division, and its Divisional Engineers, there was no organisation to carry on the original formation, and no source from which similar men could be drawn. The unit had become so small by January, 1917, that no other course was possible but to absorb it into the Royal Engineers.

One of the terms of the enlistment was that the Divisional Engineers would have the same standing as Royal Engineers. There was therefore no serious hardship in the absorption, except as it affected seniority, &c., though owing to the *esprit de corps* which had quickly developed, it was greatly to be regretted. Seniority was lost owing to the change; the men were regarded as having joined the Army at the date of transfer to the R.E.'s, their previous services of more than two years being ignored. Seniority was restored for the officers, but possibly this has not been considered with regard to further promotion.

The employment of skilled men on unskilled work has been very common during the war, not only in the Army but in civilian official work. Every man in the unit enlisted as a sapper. The officers as well as the men were employed on unskilled work. It is true that the original contract under which they joined for three years or for the duration of the war, whichever were the shorter, was broken, and the conditions under which the men joined were not retained. But this was done under an Act which applied to men in all regiments.

That their engineering experience was but little appreciated by the military authorities is a matter beyond any control or influence that the engineering institutions could exercise. The value of that experience and the enthusiasm of those who offered themselves is known to nobody better than to those members of the institutions who took part in the recruiting; and nobody can more deeply regret the waste of this fine unit than those who are proud to have been permitted to form it.

The Institution of Electrical Engineers has records of the following who enlisted in the R.N.D.:—

Officers	60
N.C.O.'s	19
Sappers	24
Killed	9
Discharged	11
	123

The total number of members of the Institution of Electrical Engineers who have joined the services is about 2,000. Circulars have been sent out by the Electrical Appointments Board to every known case, and about 600 replies have been received.

The early date of voluntary enlistment, and consequently their long service, to say nothing of the disappointments which have been experienced, should weigh with the institutions and their members in endeavouring to find appointments for men who joined as divisional engineers of the Royal Naval Division.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The New Ministry and Electricity Supply.

Following the first shock of surprise at the inexplicable inclusion of electricity supply administration as a department of the duties of the new Ministry of Ways and Communications, all efforts to realise the significance of this proposal have only served to expose its inexpediency and to consolidate opposition from all quarters.

The only possible connection with "ways and communications" is that electricity will come into greater use as the motive power on railways. But if the Minister for Railways should logically control the general supply of electricity, merely because he will some day be a large consumer, then he should at once control the coal mines of the country as being for steam locomotive purposes by far the greatest single consumer of fuel. Electricity is, in any case, only a means of transmitting the energy obtained from burning coal.

But so far from its being nationally advantageous that a Government department, as a large consumer, should have supreme power over either the supply of electricity or coal, it appears, on the contrary, that such a development might be positively dangerous to the whole prosperity of the country.

In the aggregate the greater consumption of fuel or electricity must always be in the factory and the household. The whole factory system of Great Britain is based on the supply of cheap and abundant fuel, and latterly there has been a very rapid increase in the proportion of works taking energy from the public electricity mains rather than burning coal themselves. All who have studied the economics of electricity supply will agree as to the advantage, from the point of view of diversity of load and wholesale generation, that wherever possible factories and railways should both buy their electricity from a common source. But the longer this principle is examined the clearer it becomes that neither should have exclusive powers of control. The factories represent the major interest, nothing less, indeed, than the whole industrial efficiency of the country being involved in their case; but all arguments against their selling electricity to the railways are just as strong against their buying from the railways.

The municipal authorities, to whom local prosperity is naturally all-important, cannot admit that a national railway minister would have a more careful regard than themselves for the needs of their industrial ratepayers in this respect.

It is the more strange that this ill-considered proposal should be sprung on Parliament seeing that, after prolonged investigation by a specially appointed and thoroughly representative committee, the national policy in respect of electricity supply has been the subject of a comprehensive report which, it was understood, would be reflected in early legislation.

What that report amounts to in brief is that district boards should control the wholesale generation of electricity, that supply authorities and industrial and railway consumers

should have representation on such boards, and that local distribution in detail should be undisturbed, although it will be given, undoubtedly, great stimulus by the provision of these so-called "super power stations." The national and local interests were to be watched by a body of electricity commissioners, which would see fair play as between different classes of consumers, and otherwise harmonise the organisation of supply and transmission.

Broadly, those recommendations secured general approval, and represent what is the present demand not only of municipal and company supply authorities, but of industrial consumers as well. The introduction of the Bill embodying these proposals is therefore demanded. If it be claimed that the electricity commissioners must be attached to some Ministry or other for Parliamentary purposes, then there is every reason why the Board of Trade, now reforming itself into a Ministry of Commerce, should be that Ministry, and there is every reason why one as yet unformed, and likely to be for an indefinite period more or less chaotic, should not.

L. L. Robinson, M.Inst.C.E.

Electricity Department, Hackney,
March 12th, 1919.

New Housing Schemes.

With regard to the tariff to be adopted for the supply of electricity for the medium-sized houses of the industrial districts, I am considering the adoption of a two-rate meter, to operate on one scale when passing the lighting load, say 100 watts, and to operate on another scale when passing more than 800 watts. The units on the lighting scale will be charged for at the lighting rate, and on the other scale at the heating and cooking rate.

Considerable opposition to the rateable-value system is experienced. The writer is informed that the above system has been tried at some places, and he would very much like to have opinions on the method.

W. A. Turnbull.

Electricity Works, Aylesbury, *March 17th*, 1919.

The Resettlement of Officers.

"Fed Up's" letter on the resettlement of officers struck a sympathetic chord in my breast. In spite of service in Gallipoli and France, I was unable to obtain a commission as I was "categorically unfit." In civil life, a professional electrical engineer, with a university degree, I was allocated the respective Army "trades" of linesman, instrument repairer, and electrician. Mine was by no means an exceptional case. I have seen many men of good technical education and experience cleaning down wagons, doing stable-boy's work, or even worse, doing technical jobs under the supervision of officers or N.C.O.'s with neither ability nor knowledge of the subject. As instances of the deplorable ignorance of those in authority, let me mention the sergeant who, in all seriousness, suggested that a broken battery container should be repaired with "two or three layers of stamp-edging"; and the N.C.O. instructor who lectured on magneto-generators, and drew a field (?) winding round the magnet yoke!

The root of the trouble is the lack of adequate representation of the engineering profession. The doctor, the dentist, the "vet." is recognised by the Army as a responsible worker, and is given commissioned rank. A stableman or groom will nearly always become an N.C.O.; but the engineer receives no recognition of his profession, unless he possesses "fine personal appearance, plenty of swank and bluff," when he stands somewhat less chance of a commission than a man of these attributes in the infantry.

It is up to engineers, then, to get their profession taken at its worth and given proper recognition, and it is to be hoped that in future commanding officers of technical units will be engineers as well as soldiers, and will consider technical ability a greater qualification than a martial appearance on the parade ground.

Ex-Sapper, R.E.

London, *March 15th*, 1919.

Judging from the tone of "Fed-up's" letter in your recent issue, I imagine him to be one of those awful people who considered it beneath their dignity to take a commission in H.M. Army, for the simple reason that there were some (doubtless a very small proportion) obviously unqualified men who obtained commissions. I'm sure that in the opinion of many of us there has been scarcely anybody more unpatriotic during the war than the man who, feeling convinced in his own mind that he was quite well qualified to hold a commission, and was not prevented from applying on purely personal grounds, did not come forward when there was a shortage of officers. However, from a consideration of the manner in which "Fed-up" writes, one is almost obliged to think that the number of "unqualified ones" would only have been slightly swollen had he honoured the War Office by accepting a commission.

One who is proud to have held a Commission.

March 15th, 1919.

Electrified Seed.

I am sorry to see the note signed "Charles Mercier," dated March 10th, because it is not worthy of the learned author of "New Logic," and I trust it may not be too late to prevent the lending of his great name to what he might quite rightly term "a farce," if only he could be made to realise the importance of taking into account the ravages of birds, worms, ants and corn-root lice, beetles, molds, and what our American friends call "robber-plants"—against all of which *chemical* treatment alone affords so much protection that electricity doesn't count!

You, Sir, are a better judge than Dr. Mercier now is of whether or not I am in earnest; and I beg that you will allow me to press for answers to the questions which have been asked by me in all seriousness. What I fear is that, when the whole of the facts are calmly and carefully considered, we shall find no evidence which will stand cross-examination.

Wide Awake.

March 15th, 1919.

The Association of Officers and Staff Members of Electricity (Power and Supply) Companies of Great Britain (A.O.E.C.).

I have read the letter of Mr. C. Vernier, which appears in your issue of the 14th inst.

It seems clear from the opinions expressed at the initial meeting of the A.O.E.C., held at Caxton Hall on January 30th, that there are a large number of staff officers who do not agree with Mr. Vernier's views. The A.O.E.C. was formed with the object of protecting the interests of its members in connection with the absorption or amalgamation of the companies, and it appeals to a very large number of men (both technical and commercial) who do not belong to the other associations mentioned—probably, also, to many of those who do—as constituting a strong representative body for its specific purpose.

It would appear, therefore, that such an association as the A.O.E.C. is most essential for the protection of the interests of all concerned.

O. L. Peard.

London, S.E., *March 18th*, 1919.

The Electrically-Propelled Battleship "New Mexico."

Much interest has been recently taken in the news which was published in the daily papers, to the effect that the new American electrically propelled battleship had broken down whilst escorting President Wilson across the Atlantic to the United States from France. It is true that a breakdown did occur; it was caused by one of the two steam turbine prime-movers stripping (the port side one), but the *New Mexico* was never in any danger through this trouble, which is common to all steam turbines. She was able to proceed with her starboard turbo-generator at work at a speed of 15 knots, and this in extremely heavy weather, so much so that the accompanying destroyers also had to slow down and fall out of the escort. No apprehension for the *New Mexico's* safety was ever entertained by American naval officers.

The statement that the electrical machinery had given trouble is absolutely without foundation; no trouble has been experienced; and the greatest enthusiasm is still maintained. The fact that the *New Mexico* was able to proceed with all four propellers running at the speed of 15 knots is evidence of the great elasticity and efficiency of the lay-out of plant, and the accident can be looked on as a test which has come out most successfully, compared with the havoc which would probably have been the result of half the turbine machinery going wrong in the case of an ordinary steam-turbine propelled vessel.

William P. Durtnall, M.I.Mar.E., M.I.Loco.E.

London, S.W., *March 15th*, 1919.

Three-Phase Distribution.

I am anxious to get hold of an authoritative report recommending that three-phase distribution be used throughout without conversion to D.C. This appears to be implied in various reports, and I believe it was actually recommended in the Merz Report on the London supply some years ago. I have, however, not been able to lay my hands on any report regarding it. If you could put me in the way of getting such report I should be much obliged.

C. Turnbull.

Electricity Works, North Shields, *March 17th*, 1919.

The Channel Tunnel.—Mr. Bonar Law, answering questions in the House, last week, with regard to the Channel Tunnel, said that before any action was taken consideration would be given to the comparative cost, the time in which it could be started working, and the value to industry and commerce of a train ferry, or several train ferries, across the Channel, as against a single Channel Tunnel. The sanction of Parliament would be required before the country was committed to carrying out a tunnel scheme.

LEGAL.

ANSETT *v.* SIEMENS BROS. & CO., LTD.

IN the King's Bench Division, on March 12th, Mr. Justice Rowlatt heard an action in which a lad named C. S. Ansett, of North Woolwich, claimed from defendants, of Woolwich, damages for personal injuries sustained by him while engaged at their works.

COUNSEL for the plaintiff explained that the lad had been in the employ of the defendants for some time, first as a drum-boy, and later in working a spinning machine, his duty being to look after the machine used in the manufacture of trench cable for telephone service in the trenches, for which he received 35s. a week. The cable consisted of three or four strands of wire, which, after passing through a collector, had to be taped; after that they passed over a wheel and round the drum. At about 4.30 on the afternoon of March 11th of last year, while plaintiff was engaged in his usual work, the tape broke. He mended it, but after having done so it slipped off the wheel. In order to replace it he put his foot on a girder; the latter being greasy, he slipped, and his foot was caught by a cogwheel and severely injured. He was taken to the Seamen's Hospital at Greenwich, where he remained for 12 weeks, and since then he had been unable to follow any regular employment. The allegation against the defendants was that they had neglected to keep a dangerous piece of machinery properly fenced and protected in accordance with the requirements of the Factory Act.

The defendants denied that the machine was dangerous, or that there had been any negligence on their part in not fencing it, as the factory inspector did not regard the suggested protection as necessary. They were, they said, under no statutory obligation, and the accident, they contended, was consequent upon a breach of duty on the part of the lad.

HIS LORDSHIP, after hearing the evidence on both sides, said there was no doubt as to the boy having suffered injury, and the only point in the case was whether there had been neglect to fence in a dangerous piece of machinery as required by the Factories Act. The evidence was that the particular part of the machinery was not dangerous, and that there had been no negligence on the part of the defendants in regard to it. The fact that the boy was injured did not prove that the machine was dangerous, as injury might at any time be caused by the carelessness of a worker. Although he was sorry for the boy, he was bound to come to the conclusion that he had failed in his action, and would have to content himself with what he could get under the Workmen's Compensation Act. Judgment would, therefore, be entered for the defendants.

On the application of plaintiff's counsel, his Lordship fixed the payment by the defendants to the plaintiff under the Workmen's Compensation Act at £55, and said that plaintiff would have to suffer a set-off of £10 towards the costs of the action, in which he had failed.

MEAGHER & HAYES *v.* CORK ELECTRIC TRAMWAYS AND LIGHTING CO., LTD.

MR. JUSTICE POWELL, in the High Court of Ireland, granted an order for discovery on behalf of the plaintiffs, Messrs. Meagher & Hayes, in an action against the Cork Electric Tramway & Lighting Co. for £110 alleged to have been charged for electric power in excess of the rate of charge to others in the same area. The case is listed for trial at the Cork Assizes.

BUSINESS NOTES.

German Prices Advancing.—The Sales Office of the United Manufacturers of Insulated Electric Wires has increased the prices of material of K.Y.Z wires, as catalogued, by 15 to 35 per cent. All German fittings factories have decided upon fixed prices to last provisionally five years. The price of cast-iron fittings is to be increased at once by 15 per cent., says a German paper published on February 14th.

Water-Power Plant Production at Stoke-on-Trent.—Messrs. Boving & Co., Ltd., are known in engineering circles as specialists in water-power plant, turbine pumps, and wood-pulp machinery. Until a couple of years ago they factored out their work to various shops in the country, practically leasing some smaller firms, or, in some cases, letting larger firms build machinery for them to their drawings. They also used to import water turbines and pulp machinery from Sweden. During the war, however, they acquired an engineering works at Stoke-on-Trent, and these have now been remodelled; further large extensions are contemplated, with a view to efficient manufacture of their specialities. Messrs. Boving will be able to handle the largest water turbines, and just at present they are actually putting through three turbines of 3,000 H.P. and two of 8,000 H.P., which are very soon to be followed by units of 16,000 H.P. Besides these a number of smaller turbines are also going through. The number of workmen employed is at present about 300, but it is expected that before long there will be about 600 men employed. The most labour-saving and accurate heavy machine tools are to be introduced and a rigid control will effect quick deliveries.

Export Free List.—In the Consolidated Free List of Exports in force from March 15th the following appear:—

Adding and calculating machines, electrodes, gauge-glasses, glassware; hardware for builders, if of iron or steel; iron and steel manufactures, except manufactures of high-speed steel, and except articles prohibited by name on List A or B (subject, however, in the case of machinery to the definition given under that heading); lighting fixtures, if of iron or steel; machinery of all kinds and parts (except textile machinery and machinery wholly or mainly made of copper or brass); marble (raw and manufactured).

Export Restrictions Removed.—A further list of Export Restrictions which have now been removed is published in the *London Gazette* of March 14th.

German Copper Works' Troubles.—At a meeting of the administrative and executive officials, one of the directors, Herr Kurrer, made a notable statement as to the present condition of the Mansfeldsche Kupferschieferbauende Gewerkschaft. The expenditure of the works from October 1st, 1918, to January 20th 1919, amounted to Mk. 47 millions, against which must be put a sale of Mk. 20 millions only. It must be observed in this connection that the sale fell from more than Mk. 11 millions in October to Mk. 2½ millions in December. The circumstance is significant that American copper can be delivered at a price, roughly, of Mk. 350 per 100 kg., while the prime cost of the Mansfeld copper is in the region of Mk. 700. The State has not, so far, granted the support which was asked of it. Employers of labour, really coversant with the conditions, admitted that socialisation of works which were being run almost at a loss would only accelerate the impending disaster. Nevertheless, the directors of the mine professed willingness to entertain proposals for the amelioration of the state of things, since they thought it their duty to keep in employment the 80,000 men who still depended directly on mining for their livelihood. No socialisation would abolish the necessity of working harder than ever in order to tide over the crisis, and it was regrettable that labour would not face bare facts. As things stood at present, a catastrophe was inevitable.—*D.A.Z.*, February 7th.

Real Welfare Work.—The visitor to the Welfare Department at Messrs. W. T. Henley's Telegraph Works at North Woolwich is impressed by the fact that the department takes no narrow view of its objects or its possibilities. It is recognised that something more than faultless feeding arrangements are necessary in order to get a willing and contented staff. While, therefore, the canteen appointments leave nothing to be desired, provision is also made for mental fare. At half-time, during the dinner hour, various lecturers on social and political subjects are introduced weekly. A piano is available if diversion of a lighter kind is desired. On Tuesday, 11th inst., Mr. H. Savage, the chief electrician to the company's works, gave, by request, a lantern-illustrated lecturette on "Some Interesting Facts About Submarine Cables." He was introduced by the chairman of the company, Mr. George Sutton, who announced the immediate shortening of the hours of labour in the works (an announcement that was greeted with applause), and appealed to the workpeople, in their own interests, to keep up the output of work. Mr. Savage, who was assured of his popularity by his reception, began with a statement of the reasons why copper was used, and, after showing by means of a projected ammeter its conductivity in respect of other metals, he went on to instance the work of Dr. Matthiessen, who, in spite of the physical disadvantages of paralysis from infancy, gave us Matthiessen's standard, which had been the cable-maker's guide for 50 years or more. The teredo was then shown on the screen, and its depredations illustrated. The importance of care in brass taping as a preventative of damage by submarine borers was visibly brought home to those engaged in that operation. The lecturer then went on to show and describe operations of tanking, conveyance, and laying of submarine cable, with charts of the positions of some of the more important. One striking chart showed an American-owned cable made at Silvertown crossing on the bed of the Pacific one made at Greenwich, so that in the Antipodes, Silvertown and Greenwich met in the result of their work. The universal expression of opinion, as the hooter called all hands back to labour, was that the time was all too short in which to convey the proffered instruction, which was very acceptable. Anything which gives the employé a new and intimate interest in the product of the work of his hands is welfare work of a valuable kind. Much can unquestionably be done to relieve the drabness and monotony of humdrum occupation if we only lay ourselves out for it.

The B.E.A. Directory.—THE BRITISH ENGINEERS' ASSOCIATION (INC.), 32, Victoria Street, London, S.W., has issued a new edition (1918-19) of its Official Directory of Members. The contents are rendered in English and Spanish. A general introduction explains the objects and position of the Association, and after a brief message to readers in Spain and South America, and some particulars of metric and British weights and measures, there is an alphabetical section of members' names, postal and telegraphic addresses, and the telegraphic codes used by them. Another section indicates, in tabular form, members' arrangements for representation overseas, while many pages are devoted to a classified list of manufactures.

Permits for Establishing New Businesses.—Those who have sent us inquiries in regard to this matter should take note that the Order made by the Minister of National Service relating to the granting of licences for opening new businesses, or branches of existing businesses, will in future be administered by the Ministry of Labour, and forms of application are obtainable at all Employment Exchanges.

Recent Trade-Marks Applications.—Appended is a summary of the recent applications for British trade-marks in connection with the electrical industries :—

Olipel. Nos. 387,231, 387,232, 387,233 and 386,724.—All goods in Classes 6, 8, 10 and 11. Oliver-Pell Electric and Manufacturing Co., Ltd., Granville House, Arundel Street, London, W.C. December 11th, 1918, and January 2nd, 1919.

A.G. Co. (letters combined with design), No. 381,632.—Electrical apparatus included in Class 8. Edward A. Graham, trading as Alfred Graham & Co., St. Andrew's Works, Crofton Park, S.E. August 3rd, 1918.

Compex. No. 387,349.—Electric accumulators included in Class 8. Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester. January 7th, 1919.

Cumex, No. 387,351.—Electrical accumulators included in Class 8. Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester. January 7th, 1919.

Elastride, Nos. 387,691 and 387,728.—All goods in Classes 38 and 40. St. Helens Cable and Rubber Co., Ltd., Bank Quay, Warrington. January 18th and 21st, 1919.

Megohmax, No. 387,397. Class 50.—Electrical insulating material. John Moores & Co., Brougham Street Works, Salford, Manchester. January 8th, 1919.

Megohmior, No. 387,398. Class 50.—Electrical insulating material. John Moores & Co., Brougham Street Works, Salford, Manchester. January 8th, 1919.

Government Financial Assistance for U.S. Export Trade.—Certain provisions contained in the Victory Short-Term Notes Bill, which came before the House of Representatives during the last week in February, should be brought to the notice of the British Government. The Chancellor of the Exchequer, and the Treasury in particular, should at this moment, when they are considering their relation to British industrial affairs and preparing financial policy which may be fraught with enormous consequences, take note that U.S. export trade is to be assisted by means of loans. According to the *Electrical World*, one section of the Bill authorises the War Finance Corporation to make loans to exporters and to banks, bankers and trust companies, until one year after the termination of the war, to assist in the exportation of domestic products. Because of exchange conditions, thereby necessitating some of the foreign Governments putting restrictions upon American exports to them, as it is claimed, it is believed that this provision will materially help U.S. industries in their production during the transition period, and to maintain their export business. Other particulars regarding the plan are explained in the report as follows :—

"This section authorises the War Finance Corporation to make advances for periods not exceeding five years direct to any exporter engaged in the export business in the United States, if, in the opinion of the board of directors of the corporation, he is unable to obtain funds upon reasonable terms through banking channels.

"Any such advance shall be made only for the purpose of assisting in the exportation of such products, and shall be limited in amount to not more than the contract price therefor, including insurance and carrying or transportation charges to the foreign point of destination, if, and to the extent that, such insurance and carrying or transportation charges are payable in the United States by such exporter to domestic insurers and carriers. The rate of interest charged on any such advance shall not be less than 1 per cent. per annum in excess of the rate of discount for 90-day commercial paper prevaling at the time of such advance at the Federal Reserve Bank of the district in which the borrower is located.

"This section also authorises the corporation to make advances for not to exceed five years to any bank, banker or trust company in the United States, which, after this section takes effect, makes an advance to any exporter for the purpose of assisting in the exportation of domestic products. Such advances are to be limited to not exceeding the amount remaining unpaid of the advances made by the bank, banker or trust company to the exporter for the purpose of exporting domestic products.

"The corporation cannot have outstanding under this section, and unpaid at any one time, advances in excess of $1,000,000,000."

The corporation at the time of making any advance must require adequate security.

Concert.—On the evening of March 13th a successful concert was held in the canteen at Messrs. Fuller's Works, Grove Road, Chadwell Heath. It was organised by the Fuller Works Social Welfare Committee in aid of St. Dunstan's Hostel, for which it is hoped £30 will have been raised. Mr. D. A. Palmer presided. The canteen was suitably decorated with flags and lanterns, and arrangements for stage, curtains and lighting, were carried out by Mr. Brigden, assisted by members of the Committee. The canteen was crowded, indeed the audience was larger than the most optimistic had anticipated, and many of the audience had to stand throughout the performance. The programme included the sketch "Motoring" (by kind permission of Mr. Harry Tate) presented by Mr. Tom Campbell, assisted by members of the British Lighting and Ignition Co.'s Revue Company. At half-time Mr. Donald Palmer, director of the Fuller Co., thanked the artistes, the canteen manager (Mr. Rhodes), and Mr. Brigden. Mr. Palmer apologised for the absence of Mr. Fuller, and gave a short description of the work and objects of St. Dunstan's.

Trade with Russia.—A limited number of business men who wish to proceed to Constantinople or South Russia may now do so. Application should, in the first instance, be made to the Russian Section, Department of Overseas Trade, Sunderland House, Curzon Street, Mayfair, W. 1.

U.S. Electrical Developments.—The *Board of Trade Journal* says :—"There is a suggestion for a combine between the General Electric Co., the Western Electric Co., and the Allis-Chalmers Manufacturing Co., but no practical steps have yet been taken in the matter. It is also stated that some of the lesser firms contemplate a combine for the exportation of their electrical machinery and appliances, but there is no definite confirmation of this report."

United States Copper Position.—The announcement that the famous Calumet and Hecla Co. has deferred payment of its dividend "because of the unsettled condition of the copper industry" is a fresh reminder that that industry in the United States—and, indeed, throughout the world—is still in the throes of transition. Last week the big porphyry companies—the Chino, the Nevada Consolidated, the Ray Consolidated, and the Utah—announced "cuts" in their quarterly distributions. Practically all the United States copper producers have now joined a new Export Association formed under the Webb Act. A more important recent development, however, has been the decision of the United States Government to allow its large holding of copper to be liquidated at market prices over as long a period as 15 months. Before the war the world's record annual production of copper was about 1,000,000 tons, whereas during the height of hostilities it grew to over 1,400,000 tons. Of this enormous total it is believed that at least three-quarters was being absorbed by the Allied Governments for munitions, &c. Obviously it must take time before ordinary trade demand can be re-attracted in such volume as to absorb the copious supplies of the metal now available, even allowing for the drastic slowing-down of production which is claimed to have been already effected this year.—*Financial Times.*

German Electrical Activity.—A special correspondent of the *Times*, in Berlin, says :—"Large German factories are overwhelmed with German orders. The electrical industry, for example, I was told, 'has orders for six days for every one day's work that can be turned out.' The same is true in various other factories of completed and especially non-perishable goods of high intrinsic value."

The Big American Electrical Export Scheme.—Further particulars are given in the *Electrical World* of the International General Electric Co. (Inc.), which has been organised under New York laws with a capitalisation of $20,000,000, divided into $10,000,000 of 7 per cent. cumulative preferred, and a like amount of common stock. The stock is paid in, and is all held by General Electric interests. All of the foreign interests and export business of the General Electric Co. will be under the charge of this company. The directors are C. A. Coffin, A. W. Burchard, E. W. Rice, Jun., Owen D. Young, J. R. Lovejoy, G. F. Morrison, Gordon Abbott, Sidney Z. Mitchell, George P. Gardner, Charles Neave and Gerard Swope. Gerard Swope is president of the new company and Charles Neave chairman of the board. M. A. Oudin is vice-president of the company.

Electrical Wages in Manchester District.—According to the *Manchester Guardian*, a meeting of members of the Electrical Trades Union of the Manchester district was held at the Milton Hall on Sunday to hear the report of the representatives who attended the meeting with the employers on March 6th, at which an arrangement was come to by which the principle of a minimum wage was agreed upon on the basis of a pre-war wage of 35s. per week, equivalent now to a wage of 68s. 6d. At the close of a long discussion the meeting accepted the report, and stated that had the terms offered not been satisfactory there would have been a cessation of work to enforce them.

The Importance of British Export Trade.—Sir Arthur Steel-Maitland, M.P., Director of the Overseas Trade Department, gave an address on Monday to members of the Leeds Luncheon Club on the future organisation of the Consular Service. He said it was of vital necessity to us that our foreign trade should be re-established and extended, and it was quite clear that if we did not manufacture for other countries there would be nothing for us to do but starve.

Competition in foreign trade was going to be much keener than ever before. He had proofs of it, and could lay them before anyone who wished to discuss them with him. Some people declared that the Government should steer clear of trade and not touch it at all. Others even went so far as to imagine that the Government should do their commercial travelling for them. The position really was that the Government could survey the whole field and collect information. They had no axe of their own to grind, and had no thought of dictating to business men. They wanted to co-operate with them. There was an immense field in front of them, and it was important for the Government and business men of all trades to work together.—*Morning Post.*

New Lamp Works.—The Highways Committee of the Bedfordshire County Council has considered an application from the Osram-Robertson Lamp Co., Ltd., for permission to construct a level crossing on the Leagrave Marsh and Luton Main Road, in the parish of Limbury. It appears that the company propose to acquire land adjoining this road for the purpose of erecting large works employing many thousands of hands, and they require a level crossing in order to connect their works with the line of the Midland Railway. The Committee reported in favour of sanctioning the level crossing.

Non-Ferrous Metal Industry Act.—The *London Gazette* for March 18th contains a further list of licences granted under this Act.

Catalogues.—Brittain's Electric Motor Co., 110, Cannon Street, London, E.C. 4.—Twenty-page finely illustrated catalogue of Brittain electric motors, containing a complete specification of single and polyphase motors, both squirrel-cage and slip-ring types, followed by tabulated sizes for motors ranging from 25 to 100 periods. The single-phase machines listed range from ¼ to 90 H.P., and the polyphase from ¼ to 145 H.P. In the preparation of the catalogue and of the price lists that accompany it the firm have specially kept in mind the convenience of the buyer. The various machines have been grouped into a number of sizes of frame, each marked with a distinguishing letter. A buyer can ascertain the size letter of the machine he wants, and with this in his mind he turns to the separate price lists, which are distinguished by a different coloured paper. The price table gives the size letter, price, code-word, the size and price of pulley, and so forth. The motors are built to the standard British specification. The company is translating the lists into several languages, and invites inquiries for copies.

The Midland Electric Manufacturing Co., Barford Street, Birmingham.—Folder in the form of a large show sheet, showing half-tone illustrations, particulars and prices of the M.E.M. iron-clad switch and fuse gear—Paragon, Gem, Glasgow, Kantark, and Memco designs.

Messrs. J. & W. B. Smith, Ltd., 15-23, Farringdon Road, London, E.C. 1.—Twenty-page price list (No. 132), of a variety of electrical accessories—lampholders, switches, fuseboards, cut-outs, wires, brackets, bell accessories, and so on.

Liquidations.—Osram Robertson Lamp Works, Ltd.—Winding up voluntarily. Liquidator, Mr. J. Fraser, 31, Copthall Avenue, London, E.C. Meeting of creditors March 24th. Particulars of debts, &c., must be sent to the liquidator on or before that date.

British Continental Electricity Co., Ltd.—A meeting of members will be held at 21, Finsbury Pavement, London, E.C., on April 24th, to hear an account of the winding up from the liquidator, Mr. C. E. Barker.

Fraser & Chalmers, Ltd.—Particulars of claims to the liquidator, Mr. W. McDermott, Moorgate House, Finsbury Pavement, E.C., by April 30th.

Book Notices.—*Arithmetic for Engineers.*—By C. B. Clapham, B.Sc. London: Chapman & Hall, Ltd. Price 7s. 6d. net. Second Edition. Pp. xi + 465; figs. 167.—This is one of the "D.U." Technical Series, and lives up to its title; it covers simple algebra, mensuration, logs, graphs, and the slide rule, and employs an abundance of practical examples, while all that is not "directly useful" is omitted. As we reviewed the first edition very fully in 1916, it will suffice to add that apparently the only change in the present issue is the addition of an appendix on verniers and micrometers, which are very clearly explained with the aid of many illustrations of sample settings. The book, as a whole, is thoroughly practical, and as it commences with quite elementary ideas, it is highly suitable for the use of apprentices, as well as for engineering students in general.

The Journal of the Röntgen Society, No. 56, Vol. XIV, July, 1918, has just been issued, with apologies for the delay in publication; it contains the Silvanus P. Thompson Memorial Lecture, by Prof. Sir Ernest Rutherford, F.R.S., technical articles, and the balance-sheet of the Society. No. 57 (October, 1918) has also been received, containing the annual report of the Council and a report of the proceedings at the annual general meeting held on June 4th, 1918. The membership then stood at 315. The new rules of the Society and a list of members to December 1st, 1918, are published in this issue.

Practical Electrician's Pocket-Book for 1919. Pp. lxxv + 480; illus. Edited by H. T. Crewe. London: S. Rentell & Co., Ltd. Price 2s. 6d. net.—With this issue the Pocket-Book attains its majority; but it has been handicapped by the stringency in the paper supply, and though it is very fat and prosperous-looking, it has not been so largely increased in size as the Editor had hoped. New chapters on electrical pyrometers and the oscillograph have been added, that on electric vehicles has been rewritten, and other sections have been revised and extended, whilst improvements have been effected in other ways. Excellent before, it is still better now, and will meet with a cordial welcome.

"Mechanical World Year-Book, 1919." Pp. 272; 80 figs. Manchester: Emmott & Co., Ltd. Price 2s. net.

"Can we Compete?" By G. E. Mappin. Pp. 159. London: Skeffington & Son, Ltd. Price 4s. 6d. net.

"Induction Coils." By G. E. Bonney. Revised by A. H. Allen. Pp. x + 198; 80 figs. London: Sir Isaac Pitman and Sons, Ltd. Price 6s. net.

Beama Revista Trimestral Ilustrada de Ingenieria. March, 1919. London: B.E.A.M.A.

Heat Treatment Bulletin No. 8, issued by Automatic and Electric Furnaces, Ltd., describes the methods of holding a number of small articles for simultaneous treatment in the furnace.

"*Journal* of the Institution of Municipal Engineers." Vol. VII, No. 25. February, 1919. London: The Institution. Price 1s.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII, No. 2. February, 1919. New York: The Institute.

Trade Announcements.—Mr. Schattner, who was the original founder of the Electrical Apparatus Co., Ltd., and has held the office of chairman since its formation 12 years ago, resigned the chairmanship on March 1st, owing to indifferent health, aggravated by the severe strain of managing a manufacturing business for four years under war conditions with a depleted staff. Mr. Schattner will retain his seat on the board, to act in an advisory capacity. He will also join the board of several other electrical companies, after a period of recuperation during which he will visit France, Italy, and the Balkans, partly in the interests of the Electrical Apparatus Co., Ltd. On February 28th, Mr. Schattner was entertained by his colleagues on the board at a dinner at the Savoy Hotel, on which occasion they presented him with a gold watch, and on March 11th he was the guest of honour at a dinner arranged by the staff, at the Holborn Restaurant. He was presented with an illuminated address. During the 12 years of Mr. Schattner's chairmanship, there has been rapid and steady growth of the company's business. There will be no change in the constitution of the board. Mr. R. H. Barbour, M.A., has been elected chairman; and Major R. Amberton, who has been absent on military service since the outbreak of war, is taking over the commercial organisation, and the complete board is constituted as follows:—Mr. R. H. Barbour, M.A. (chairman); Major Amberton (commercial organisation); Mr. G. R. Moore (administrative); Mr. H. R. C. Partridge (works superintendence); Mr. E. Schattner (advisory); Capt. E. A. Godson, M.C. (financial); Mr. H. Taylor, A.S.A.A. (secretary).

Mr. W. J. Lattimer, having been demobilised, has resumed business as an electrical engineer and contractor, at 203, Lower Addiscombe Road, Croydon.

In order to meet the increasing demand for Wild-Barfield electric hardening furnaces, new premises have been secured for works, and the works address of Automatic and Electric Furnaces, Ltd., is now 281-283, Gray's Inn Road, W.C. 1.

The Concordia Electric Wire Co., Ltd., state that business delays are occurring owing to customers addressing them at *Queen* Victoria Street, instead of 155, *Victoria* Street, S.W. 1.

Mr. Albert Morgan is now demobilised, and is trading as an electrical and mechanical engineer, at 138, Gower Street, London, W.C. 1. He wishes to receive manufacturers' catalogues and latest prices.

The Electrical Apparatus Co., Ltd., have removed their Scottish branch office in Glasgow from Hope Street to 74, York Street. Temporary telephone number, "Central 3467." Their branch manager, Mr. J. Ferguson, regrets any inconvenience caused to customers during the removal.

Lieut. George Preece, R.E., has been released from the Army, and has been appointed Yorkshire representative of Messrs. James Howden & Co., Ltd., Glasgow, and of Messrs. Mavor & Coulson, Ltd., Glasgow. His offices are at Telegraph Chambers, Market Street, Bradford.

Bankruptcy Proceedings.—William T. Smith, electrical and mechanical engineer, Victoria Street, and 60, Hampden Street, Bolton, Lancs. Although the creditors of the above debtor had agreed to the adjournment of his case for three months, the Official Receiver pressed for an order at Bolton, on March 12th. The Registrar, Mr. C. H. Hulton, was not at first inclined to grant any further adjournment, pointing out that several adjournments had already been granted to see if Smith could dispose of a war patent. Nothing had come of that, and now an adjournment was asked for to see if he could dispose of pre-war patents. On the debtor stating that he could complete negotiations for those patents inside one month, and then pay 20s. in the £, the Registrar granted an adjournment for one month.

LIGHTING AND POWER NOTES.

Arbroath.—Street Lighting.—The Arbroath E.L. and P. Co. has asked the T.C. whether the electric lighting of the streets is to be continued.

Ashton-under-Lyne.—Proposed Extensions.—The T.C. has approached the Hurst U.D.C. with a view to supplying electricity within its area.

Aughton.—Extension of Time.—The Ormskirk Gas and Electricity Co. has decided to apply to the B. of T. for an extension of the time for the laying of electricity mains to Aughton.

Australia.—Victoria.—Alkali Manufacture.—The Melbourne *Leader* states that Messrs. Brunner, Mond & Co. intend erecting a large factory for the manufacture of alkali in Victoria, and a representative of the company is negotiating with the State Government on the matter.

National Electricity Supply.—During a discussion on the Electricity Commissioners' Bill in the Legislative Assembly, the Minister of Railways stated that the Morwell brown-coal field would be the best and cheapest site for the production of electricity, although the possibilities of water power would be ascertained. It would be the duty of the Commissioners to secure co-ordination of all State or other electricity undertakings, and secure the adoption of standardisation of plant, voltage and distribution. The Premier stated that the measure would not exclude the utilisation of water power.

Sydney.—Water Power.—The Local Government Association has brought before the Minister of Works a scheme for the utilisation of the water power at Barren Jack: the cost is estimated at £300,000, and it is stated that the scheme would provide sufficient energy to supply the whole of Sydney.

Depreciation of Plant.—For the purpose of calculating the amount to be paid annually to the depreciation account, the Sydney (N.S.W.) Council has adopted the following schedule, which is to be revised periodically, in connection with its electricity

undertaking :—Buildings, underground and overhead mains, and house services, 50 years ; machinery, apparatus, &c., 20 years ; motors, 17 years ; conveyors, hoppers, and meters, 12 years ; land, infinity.

Bandon.—E.L. Scheme.—The T.C. has appointed a Committee to consider proposals for the electric lighting of the town, put forward by the Clonakilty E.L. Co. and Mr. Joseph Brandon, a local mill-owner.

Bootle.—Year's Working.—During the past year the income of the Corporation electricity undertaking increased by £2,674, whilst loan charges increased by £4,407 and working expenses by £10,983 ; there was a deficit of £8,552.

Bradford.—L.G.B. Inquiry.—Colonel Ekin, of the L.G.B., held an inquiry, on the 11th inst., into the application of the Corporation to borrow £295,125 for extensions at the Valley Road and Bolton Road electricity works, and £74,000 for transformers and mains. Mr. T. Roles, the borough electrical engineer, stated that up to two years ago the undertaking was the most economical in Yorkshire, as far as coal consumption was concerned, with an average of 2·49 lb. per unit. The output increased from 24,418,282 units in 1912-13 to 55,539,998 in 1917-18, and he anticipated that this rate of increase would continue. Since the restrictions regarding the small power and lighting consumers had been withdrawn, there had been an abnormal rush of applications for supply, and at present 332 applications, for a total of 4,800 kw., were in hand. In view of the present conditions and the proposed linking-up schemes, it was difficult to state the proportion of "spares." The undertaking was already linked-up with the Yorkshire E.P. Co., and he anticipated that, apart from any Government scheme, Bradford would link-up with Leeds and elsewhere. They were paying an average of 21s. to 22s. per ton for coal ; in 1912, coal cost ·142d. per lb., whereas in 1918 it was ·313d. Details of the proposed extensions are as follows :—Turbo-generator, with auxiliaries, £118,249 ; three boilers, fans, pipes, chimneys, &c., £85,510 ; four forced-draught cooling towers and foundations, £17,600 ; extension to suction ash plant, £5,500 ; three rotary converters and mains, £61,556 ; cable ducts, £6,050 ; portable coal elevator, £660.

Continental. — Austria. — A Committee for the standardisation of frequency and voltage in Vienna has published its recommendations, which refer to lighting and power transmission, but excepting traction, as a draft for discussion, says *Elektrotechnik und Maschinenbau*. The frequency of 50 cycles per second, and the following voltages are recommended :—D.C., 110, 220, 420 volts ; A.C., 220, 380, 3,000, 5,000, 10,000, 15,000, 20,000, 35,000, 50,000, 75,000, 100,000 volts.

Darlington.—Price Increase.—The Electricity Committee has recommended that, from the end of March, the charges for electricity for power and lighting be increased by one-sixteenth of a penny per unit, and that the charges for all D.C. supplies be advanced by a further 5 per cent.

East Anglia.—National Electricity Supply.—The municipal electrical engineers, town clerks, and chairmen of Electricity Committees of Norwich, Yarmouth, and Lowestoft are to hold a Conference regarding the Government proposals for the establishment of a national electricity supply. There is in East Anglian municipal circles widespread opposition to the proposal to place the control of electricity supply under the Minister of Ways and Communications.

Grimsby. — Proposed Extensions. — Plans for the extension of the municipal electricity undertaking, estimated to cost £100,000, will be considered at next month's meeting of the T.C.

Hardingstone.—Mains Extensions.—The U.D.C. has granted permission for the Northampton E.L. & P. Co. to erect overhead mains within its area.

Hastings.—Proposed Loan.—The T.C. has applied for a loan of £5,000 for electricity services.

Hatfield.—Mains Extensions.—The R.D.C. is to consider the question of granting the N. Metropolitan E.L. Co. permission to lay mains within its area.

Hebburn-on-Tyne.—Street Lighting.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £5,850 for the provision of 606 new lamp-posts, this being the amount which the Council agreed to pay towards the scheme of the Northern Counties E.S. Co. for public lighting.

Holywood (Co. Down).—Proposed Increased Lighting.—The U.D.C. has appointed a Sub-Committee to consider the question of increasing the lighting of the town by the utilisation of water-power.

Huddersfield.—L.G.B. Inquiry.—On March 13th, Colonel T. C. Ekin, of the L.G.B., held an inquiry into the application of the T.C. for a loan of £90,000 for extensions in connection with the electricity undertaking. The proposed new plant included a 6,000-kw. alternator (estimated cost, £42 000), boilers (£26 000), cooling towers, switchboards, mains, transformers, and extensions to the coal bunkers and conveyors. The town clerk stated that the sewerage department and manufacturers required an additional 4,000 kw., and the tramway department, which desired to scrap its power station and obtain energy from the electricity department, required 1,000 kw. ; the National Shell Factory required 800 kw., and numerous applications had been received from small consumers. It was hoped eventually to scrap the out-of-date single-phase plant, and the total plant would ultimately be capable of an output of 15,000 kw., with a maximum demand of 8,700 kw. Between 1912 and 1917 the undertaking contributed £12,750 to the relief of the rates, but during 1918 there was a loss of £8,000. Before the war they had bought coal at 7s. 6d. per ton ; it was now 28s. per ton, whilst the percentage of ash had risen from 15 to 40. The Inspector said he would recommend the application, which was unopposed.

Leeds.—Price Increase.—The recent increases in the charges for electricity (referred to in our last issue) are estimated to produce an average of 4·6d. per unit for private lighting, 1·2d. for power, and 1·5d. for lighting and rateable-value supplies.

Letterkenny (Co. Donegal).—E.L. Scheme.—The U.D.C. has adopted an electric lighting scheme for the town.

London.—Public Lighting Rates.—The B. of T. states that no useful purpose would be served by an inquiry into the rates charged for the supply of public lighting by public undertakings as compared with private undertakings, and as to the standardising of lighting particularly in London and Greater London.

Development Scheme.—The South-Western Divisional Committee of London Electricity Undertakings urges immediate steps to secure the development and inter-connection of existing stations and the provision of a site for a bulk-supply station. It points out that unless local authorities are in a position to prove that they are organised to deal with any necessary extensions they will most likely be very seriously prejudiced by the suggested fresh Government legislation.

Fulham.—Price Increase.—The B.C. has increased its charges for electricity from 6d. to 7d. per unit.

Hammersmith.—Proposed Linking-Up.—Owing to the delay in the proposed Hammersmith-Battersea-Fulham scheme for the linking-up of electricity supply, the B.C. has invited the Battersea and Fulham Councils to appoint deputations to confer with the Hammersmith B.C. on the question, with a view to settling any differences at an early date.

Stoke Newington.—Mains Extensions.—The E.L. Committee has recommended that the electricity mains be extended to Millard Road, at a cost of £102.

Malvern.—Proposed Extensions.—The U.D.C. has decided to canvass West Malvern as to the advisability of extending electricity mains to that district. The cost is estimated at £4,000.

Matlock.—E.L. Scheme.—The U.D.C. has decided against the scheme of a Glasgow firm to supply the town with electricity, and has expressed the opinion that the matter should be taken up by the Council itself.

Paisley.—Proposed Extensions.—The T.C. has decided to seek permission to borrow £59,500, for extensions in connection with the electricity undertaking. The scheme includes a sub-station in West Croft Street, E.H.T. mains, transformers, two boilers, &c., which will be required in order to supply the Paisley District Tramways Co. and large power consumers in the district.

Rochdale.—Developments.—Mr. F. H. Rudd, borough electrical engineer, gave an address last week on the growth of the local electricity works. The supply was commenced in 1900, and in the first year the supply was 90,000 units for lighting and 2,276 for power. In 1914 the output was 6½ million units, but in 1917 it had increased to 16 millions. In future, power stations would have to be erected on a much larger scale, as the demands would be so great as to almost dwarf the present loads. The Corporation would not be justified in incurring any expenditure on the power station other than was absolutely necessary, as any alterations would be outgrown in a short time. It had been practically decided to meet the immediate extra demands for power in Rochdale by taking a bulk supply from the Lancashire E.P. Co., whose generating station was at Radcliffe, eight miles distant. Overhead mains would be constructed along almost the whole of the route, at a pressure of 10,000 volts.

South Africa.—Strike.—According to the daily Press, the power-station hands and tramway men have struck, and the town of Pretoria is without electricity. Other public services are disorganised, and it is said that there is grave unrest among miners and artisans of all classes, which may at any moment lead to a serious situation.

South Molton.—E.L. Scheme.—The T.C. has decided to consult an electrical engineer as to the practicability of harnessing the river Mole for the generation of electricity.

Stoke-on-Trent.—Church Lighting.—The Council has agreed that the price of electricity supplied to places of worship shall be at the same rate as that supplied to kinemas.

Tiverton.—E.L. Scheme.—The T.C. has referred to the Lighting Committee a proposal to secure an E.L. installation for the town.

TRAMWAY AND RAILWAY NOTES.

Allerton (Yorks.).—Proposed Extensions.—The P.C. has asked the Yorkshire (W.R.) Electric Tramways Co. to extend its service from Castleford to Allerton-Bywater.

Ashton-under-Lyne.—Proposed Loan.—The Tramways Committee has decided to apply to the L.G.B. for sanction to borrow £4,150 for increased shed accommodation required by the taking over of part of the system of the Oldham, Ashton and Hyde Co.

Bo'ness.—Electric Vehicle.—The T.C. has purchased an electric vehicle, at a cost of £1,005, for the collection of refuse.

Burton-on-Trent.—Proposed Loan.—The T.C. is to apply for a loan of £3,400, for tramway depôt extensions, overhead equipment, and rails.

Continental.—Spain.—Strike.—The situation at Barcelona is becoming worse than ever. Martial law was proclaimed last week, which step was taken after new strikes by the tramwaymen and other transport workers. Strikers who were called up for military service, and who resisted their officers, have been imprisoned. All public services are running under military organisation.

About 90 tramcars, operated by soldiers, were run on Sunday last, but were boycotted by the workmen. A meeting between the company and the strikers, with a view to arriving at an understanding, ended in complete failure.

Edinburgh.—Tramway Electrification.—After inspecting the tramway systems in London and Bournemouth, a deputation of the Tramway Committee has come to the conclusion that the conduit system for Princes Street is "well worth consideration."

The Tramway Committee has agreed upon the provision of fifty top covers for existing cars.

Mr. Pilcher, the manager, is to make arrangements regarding an administrative staff, and to advertise for a traffic superintendent at a salary of £450 per annum.

Egypt.—Following on the arrest and deportation of certain agitators, several demonstrations took place at Cairo, last week, when shops and tramway cars were attacked, and in consequence the tramway services ceased running on Tuesday, last week.

Great Yarmouth.—Year's Working.—A deficit on the tramway undertaking of £3,500 is to be covered from the rates.

London.—Tramcar Fire.—A fully-laden L.C.C. tramcar took fire on Wednesday, last week, in the Peckham Road, Camberwell. No passengers were hurt.

Derailments.—Much inconvenience was caused to City workers on Thursday, last week, by three tramcar mishaps. In the Walworth Road, where the track is under repair, a car left the metals and got into a hole at the side. It was by the merest chance that the car did not turn completely over. Traffic was held up, and at one time there was nearly a mile of waiting cars. The service in New Cross Road was also held up, owing to the fouling of a car's plough; while at Deptford, too, tramway traffic was suspended owing to a car leaving the track because of an obstruction in the central conduit rail. It took a considerable time to clear the line.

Tramway Season Tickets.—Notice of motion has been given that it be referred to the L.C.C. Highways Committee to consider the question of issuing monthly and quarterly season tickets on the Council's tramway service.

Post Office Tube.—A White Paper, issued last week, shows that out of £1,000,000 sanctioned for the construction of the Post Office tube railway in London, £714,466 was expended up to March 31st, 1918. Tunnelling alone cost £561,917 up to that date.

New Zealand.—Auckland.—Negotiations are in progress between the Auckland Electric Tramways Co., Ltd., and the City Council, with a view to the acquisition of the undertaking by the municipality.

Northampton.—Breakdown.—Owing to a breakdown at the generating station, on March 8th, the tramway service was disorganised during the week-end.

Morley.—L.G.B. Inquiry.—An inquiry was held last week into the application of the T.C. for a prov. order to extend the railless trolley system from Leeds to Ardsley, *viâ* Morley, a total length of 7 miles.

Musselburgh.—Fare Revision.—The Musselburgh and District Electric Light and Traction Co. has received B. of T. sanction to increase its tramway fares by 50 per cent., with a minimum of 1d. for workmen's fares.

United States.—Strikes.—The tramway strikes at Newark and New Jersey have practically stopped passenger traffic; service men have refused to work the systems.

TELEGRAPH AND TELEPHONE NOTES.

Buenos Aires.—The employés of the telephone companies have gone on strike.

India.—An auxiliary wireless service has been established by means of the existing Government stations to augment the cable service to India.

Isle of Man.—Pending the repair of the submarine telegraph cable between the Isle of Man and England, the public telegraphic service is now being conducted by wireless at the usual Inland rates. The Admiralty installation at Douglas is being used, the English station being situated at Heysham.—*The Times.*

Marconi Co. and the War.—The Postmaster-General, in reply to a question in the House last week, stated that the Government had made considerable payments on account of the services rendered by the Marconi Co. during the war at stations in this country, and proposed a basis of settlement to the company in May last, which was not accepted. The services had now practically ceased, and the question of making a further offer to cover the period up to the date of cessation was under consideration.

The amount of damages for the cancellation by the Government of the contract for the proposed Imperial wireless chain was remitted by the High Court to an arbitrator. The company has formulated a claim, but a date has not yet been fixed for the hearing.—*The Times.*

Poland.—The Minister of Posts and Telegraphs, in view of certain defects in the construction of the network of wireless stations erected by the occupying powers, intends to build a new network. The cost of constructing the central station is estimated at Mk. 250,000, and the smaller ones at Mk. 30,000.—*Nowa Reforma.*

Priority Abolished.—On Tuesday the Postmaster-General abolished Government priority telephone calls. Priority in future will be allowed only to Cabinet Ministers and certain heads of departments at the War Office, and then only by the use of a code word. At the same time, an Order severely limits Government Department priority rights on cables. Government and non-Government messages will in future be sent at all cable stations during alternate half-hours. If Government cables are still excessive, priority rights will be abolished entirely.

Spain.—At the opening of the new commercial wireless service between Great Britain and Spain on March 13th, messages of congratulation were exchanged between the King of Spain and Senatore G. Marconi.

Telephone Breakdowns.—In answer to a question in the House of Commons last week, the Postmaster-General stated that complaints had been received concerning the telephone service at Manchester. Approximately 15,000 subscribers' lines were broken by the snowstorms in that area on January 4th, in addition to a large number of main telephone and telegraph lines. About 11,000 subscribers' lines had already been repaired.

Trans-Atlantic Wireless Telephony.—It is announced by the Marconi Co. that it has succeeded in establishing wireless telephonic communication between Ireland and Canada.

United States.—The Navy Department has released the high-power stations of the Marconi Co. at Belmar, N.J., and at Chatham, Mass.

The Court of Errors, the Court of last resort in the State of New Jersey, on January 7th affirmed the judgment against the Marconi Co., awarding royalties of $300,000 to the International Radio Telegraph Co., of New York.

Wireless in the Air Service.—Major-General Seely, Under-Secretary for Air, in introducing the air estimates for the ensuing year, in the House last week, speaking of the aerodromes which will be required in this country for civil aviation, said that they would be fitted, amongst other signalling systems, with telephone and telegraph stations, with directional wireless enabling machines to be directed from the ground, and, he was glad to say, with wireless telephones, in which only in the last few days they had achieved a result which they had been trying to secure for years. Until a few days ago it was possible for one aeroplane to communicate with another, but not to receive the answer. They now had a wireless telephone with which they could both send and receive on the same instrument.

According to the *Daily Mail*, a squadron of British aeroplanes passing over the City on Friday afternoon kept up communication by means of wireless telephony. In this system the receiver of an ordinary wireless telegraph set can be adjusted, it is said, to receive the spoken message, as well as the Morse code, from a telephone transmitter. The perfection of the wireless telephone has been the result of very extensive work at the R.A.F. experimental station at Biggin Hill, following original research work by the R.F.C. at Woolwich. As far back as March, 1918, British machines were being controlled by telephonic orders, and to-day, it is claimed, conversations can be held with machines over 150 miles from the control station, and trailing aerials are no longer necessary. Conversation can be held without talking through the lips at all, thus the pilot's message is not drowned by the roar of the engine. An appliance has been invented which is placed round the pilot's throat, so that when he speaks the movements of the throat are transmitted as words.

Wireless Operators.—No amicable settlement having been come to between the Marconi Co. and the Shipping Federation and the Association of Wireless Telegraphists as to the payment of the bonus which was arranged to be paid to the operators in October last, the Wireless Telegraphists' Association gave notice to the Ministries of Shipping and Labour that action was to be taken on Monday by the operators. The Association contends that the operators are entitled to the special war risk bonus of £3 a month which was granted to the mercantile marine in October, 1918.—*Birmingham Post.*

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW *in which the "Official Notice" appeared.*)

OPEN.

Australia.—SYDNEY.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

April 28th. Municipal Council. Power transformers. Electrical Engineer, Town Hall, Sydney.

May 15th. Department of the Treasury, Brisbane. H.T. switchboard, storage battery and motor-generator set for the Electric Power House, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

Bedford.—Corporation Electricity Department. Geared turbine to drive an existing alternator. (See this issue.)

Grimsby.—April 10th. Corporation Electricity Department. One 3,000-KW. steam turbine, 6000/6600-volt, 3-phase alternator, condenser, pumps, &c.; two water-tube boilers, stokers, superheaters, fans, steel chimney, &c.; cooling tower, &c. (See this issue.)

Ipswich.—Corporation Electric Supply Department. Pipework in connection with the new steam turbine. (March 14th.)

Liverpool.—March 25th. West Derby Union. Electric supplies from April 1st to June 30th. Mr. H. P. Cleaver, Union Clerk, Union Offices, Brougham Terrace, Liverpool.

London.—March 27th. West Ham Union. B. of G. Six months' supply of electrical fittings. Mr. T. Smith, Clerk to the Guardians, Union Road, Leytonstone, E.11.

OFFICE OF WORKS.—One 300-KW. Belliss generating set, or two 150-KW. Belliss generating sets. (See March 14th.)

Manchester.—March 25th. Corporation Tramways. Copper and bronze trolley wire. Specification, &c., from Mr. J. M. McElroy, General Manager.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Bradford.—Electricity Committee:—

Two oil switches for 1,500-KW. rotary converters.—British Westinghouse Co., Ltd.
Spare battery for electric tipping wagon.—Chloride Electrical Storage Co., Ltd.
Two Tray coal conveyors.—Goodall, Clayton & Co., Ltd.
One 30-ton electrically-driven travelling crane.—Thos. Broadbent & Sons, Ltd.

Tramways Department:—

Copper rail bonds, £363.—B. I. & Helsby Cables, Ltd.
Five miles of round copper trolley wire, £572.—Thos. Bolton & Sons, Ltd.

Winchester.—T.C. House service meters for a year. Messrs. Chamberlain & Hookham.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, March 21st. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Jigs, Tools, and Special Machines with their Relation to the Production of Standardised Parts," by Mr. H. C. Armitage.

Electro-Harmonic Society.—Friday, March 21st. At 7.45 p.m. At the Holborn Restaurant (Venetian Chamber). Smoking Concert.

Institution of Electrical Engineers.—Friday, March 21st. At 1, Wimpole Street, W. 1. At 8 p.m. Joint meeting with the Royal Society of Medicine (Electrical Section). Papers on "Some Notes on Electrical Methods of Measuring Body Temperatures," and "Some Notes on the Electro-Cardiograph." by Mr. R. S. Whipple.

Thursday, March 27th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Paper on "The Co-ordination of Research in Works and Laboratories," by Mr. J. S. Highfield.

(North-Eastern Centre).—Monday, March 24th. At the Mining Institute, Newcastle. At 6.45 p.m. Paper on "The Determination of the Efficiency of the Turbo-Alternator," by Dr. S. F. Barclay and Dr. S. P. Smith.

(North-Western Centre.)—Tuesday, March 25th. At the Engineers' Club, Manchester. At 7 p.m. Popular lecture on "The Atom of Electricity," by Sir Ernest Rutherford, F.R.S.

(South-Midland Centre).—Wednesday, March 26th. At the University, Edmund Street, Birmingham. At 7 p.m. Paper on "Condensers," by Mr. R. J. Kaula.

(Students' Section).—Tuesday, March 28th. At 7 p.m. At the City and Guilds (Engineering) College, South Kensington. Lecture on "The Organisation of Technical Engineers," by Dr. J. F. Crowley.

Junior Institution of Engineers.—Friday, March 21st. At 7.30 p.m. At 39, Victoria Street, S.W. Social evening.

Royal Institution of Great Britain.—Saturday, March 22nd. At Albemarle Street, W. At 3 p.m. Lecture on "Spectrum Analysis and its Application to Atomic Structure," by Sir J. J. Thomson, F.R.S.

Electrical Power Engineers' Association (Glasgow Section).—Saturday, March 22nd. At the Trades House Restaurant, Glasgow. Dinner.

Manchester Association of Engineers.—Saturday, March 22nd. At the Grand Hotel. At 6.30 p.m. Annual meeting. Paper on "Development of Reinforced Concrete," by Mr. B. Taylor.

Royal Society of Arts.—Monday, March 24th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor lecture on "Fuel Economy," by Prof. W. A. Bone, F.R.S. (Lecture III.)

Wednesday, March 26th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "British Engineering and Hydro-Electric Development (the Training of Engineers)," by Prof. A. H. Gibson.

Institution of Civil Engineers.—Tuesday, March 25th. At 5.30 p.m. At Gt. George Street, S.W. Further discussion on papers on "Electric Welding."

Industrial Reconstruction Council.—Tuesday, March 25th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "The Place of the Merchant in British Industry," to be opened by the Hon. F. M. B. Fisher.

Physical Society of London.—Friday, March 28th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Discussion on "Metrology in the Industries," to be introduced by Sir R. T. Glazebrook, F.R.S.

NOTES.

Electro-Harmonic Society.—The last smoking concert of the season will be held at the Holborn Restaurant in the Venetian Chamber to-night (Friday), commencing at 7.45 p.m. Mr. F. A. B. Lord, C.C., will be in the chair. Artistes:—Mr. Gale Gardner, tenor; Mr. Walter P. Scott, bass; "The Three Freds"—Mr. Fred Gregory, baritone; Mr. Fred Gibson, humorist; Mr. Fred Wildon, Phonofiddleoddities; Mr. Fred Curtis, comedian; Mr. Warwick Pryce, musical sketch at the piano; and Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

Copper Prices.—Messrs. James & Shakespeare report March 19th, copper bars (best selected), sheets and rods, £114.

Wiremen in the Navy.—The Admiralty has sanctioned the establishment as from June 10th, 1918, of the following rates of pay:—

	s.	d.	
Wireman, 2nd class	2	8	a day.
Do. over three years...	2	11	"
Wireman, 1st class	3	3	"
Do. over three years as such ...	3	6	"

Time served in the obsolete rating of armourer's crew (wireman) is allowed to count as service as wireman 2nd class.

Scientific Management.—The following series of lectures has been arranged by the Industrial Reconstruction Council to take place at the Institute of Journalists, 2 and 4, Tudor Street, E.C. 4. There will be a different speaker at each lecture, which begins at 5.30 p.m., and is followed by a discussion. No tickets are necessary:—

April 1st.—"The Determination of Standards in Scientific Management."
" 15th.—"The Planning Department in Scientific Management."
" 29th.—"Incentives to Efficiency in Scientific Management."
May 13th.—"Costing in Relation to Scientific Management."
" 27th.—"The Relation of Welfare Work to Scientific Management."
June 10th.—"The Benefit to the Workman of Scientific Management."

National Electricity Supply.—According to the *Daily Dispatch*, Mr. Waddington, Captain C. Ainsworth, Mr. Marshall Stevens, Captain Barnett, and Mr. Lewis Haslam, form a sub-committee which has been appointed by the Commercial Committee of the House to watch national electricity questions at Westminster.

Appointments Vacant.—Station superintendent (£226), for the Rawtenstall Corporation Electricity Works; lecturer in electrical engineering (£300, rising to £350), for the University of Bristol Merchant Venturers' Technical College. See our advertisement pages to-day.

Rebuilding a 25,000-KW. Parsons Generator.—A number of years ago the Commonwealth Edison Co. installed in its Fisk Street station a Parsons turbine driving a 25,000-KW. generator. The turbine had considerable margin of overload capacity, and it was decided to reconstruct the generator to make this a 30,000-KW. machine. The process has been carried out satisfactorily.

Engineering Developments in Occupied Territory.—The Manchester *Daily Dispatch* hears "that the Government are about to send a mission—consisting of representatives of the electrical and engineering concerns, and also the machine tools and textile industry—to the occupied territories of Germany and Austria to investigate the developments of engineering during the war. The mission is under the direction of the Ministry of Munitions."

The Transport Bill.—The transport system of this country is in a state of chaos, and quite incapable of meeting the demands which are going to be made on it, Sir Eric Geddes told the House on Monday, in explanation of the far-reaching powers which he is seeking under the Ministry of Ways and Communications Bill. The importance of the transport problem was urged in forceful terms, and Sir Eric said he was not exaggerating when he stated that, with the exception of the municipal tramways, this country's transport systems were to-day financially in a semi-paralysed state. They were in that state either because they were not very prosperous before the war or because they had had the shadow of nationalisation overhanging them, and their development had been retarded through capital expenditure not being undertaken. Further, apart from their financial position, they were physically ill-equipped to meet the great strain upon them, and they ought to be put back on a paying basis. In the past private interest made for development; to-day it made for colossal waste. On the subject of electricity, Sir Eric denied that as a transport authority the industrial requirements of a district would be disregarded. Transportation was not merely carrying something from A to B; it was the greatest power that they had for bringing prosperity to the community, and for developing the districts served by it. In everything that made for the prosperity of the district itself, it was in the interests of the transportation agency to push it, and the suggestion that such an agency, with electricity of all things, would desire to penalise the manufacturer could only be put forward by one who did not understand really what they were after. It was estimated conservatively, that when they got through the electrification of the main lines, which should be done and done promptly—and it would be undertaken if the Bill became law—fully 20 per cent. of the electricity of the country could be used for traction. There was no estimate of the actual cost, but from their experience of actual experiment, it was a very remunerative proposition. The advantage of electrification was not only in the reduction of the price of energy, but also in the extra traffic that could be worked over the line, so that there was a still further advantage in developing industrially the district that was electrified. As the lines of railways were the most direct, the safest, and the easiest routes for the H.T. transmission lines, and it was in every way in the interests of the railway and transportation agency to get electricity spread out into the industrial areas, it was really a fallacy to suppose that it would be against the interests of the railways and the Ministry as a whole to develop the industrial use of electricity. The difference between co-operative use and co-operative production of electricity was enormous, and there was no district in this country where electricity was better organised to-day than along the North-East Coast. There the Electric Power Co. had worked hand-in-hand with the North-Eastern Railway. There they had a joint organisation—he was instrumental in setting it up—for attracting industry to and developing industry in the district. They jointly arranged for placing the power stations near the coal mines, and developing the economic use of waste heaps. That was not against the interests of the railway, because it developed the prosperity of the district, and it was in that spirit only that they looked at the question.

British Engineering Standards Association.—It is announced in the *Journal* of the Institution of Electrical Engineers that the Sub-committee on Electrical Accessories (Mr. C. H. Wordingham, chairman) has completed the preparation of the following specifications:—

Electricity meters (B.S. Report No. 37/19).
Ordinary duty cut-outs (B.S. Report No. 88/19).
Motor starters (B.S. Report No. 82/19).

A number of other specifications for electrical apparatus are on the point of completion. Owing to the wide range covered, the Sectional Electrical Committee has set up additional sub-committees to deal with electricity meters (Mr. C. C. Paterson, chairman), electrical instruments (Mr. E. B. Vignoles), electric control gear (Mr. C. H. Wordingham), and heating and cooking apparatus (Mr. S. T. Allen).

The Association has had in hand the preparation of specifications for aircraft material, and a Sub-committee on Electrical Parts (Mr. C. C. Paterson, chairman) has dealt with electrical apparatus; eight specifications have been issued, and will probably come up for revision in due course by the electrical section of the Association.

Fatality.—An inquest was held last Friday, at Ripon, into the cause of death of Ernest Pogson (30), chief engineer at the electric power station, North Camp, who was killed on the previous night. The medical evidence showed that artificial respiration and other measures were tried for some time, but without success, and that death was due to heart failure, the result of electric shock. The technical evidence showed that deceased was working at the power station behind the cubicles. He put his left hand inside the No. 2 cubicle to trace the wire; his right hand was resting on the iron framework. He had no rubber gloves on, but had one foot on the rubber mat. Previous to putting his hand into the cubicle he had tested the terminals, and said there was no current. He then had the gloves on. All the cubicles had been shut down except No. 2, and the engine driving the dynamo was running light, and was not supposed to be generating current. J. T. Shepherd, who was working with him, suggested shutting down the engine altogether, but deceased said it was all right. Deceased could not have done what he intended to do with the gloves on. The only reason why the engine should not have been stopped was that it would have delayed the supply of electricity. Second Lieut. A. Redfern, district electrical and mechanical engineer, Northern Command, Darlington, said that upon examination after the accident he found that all high-tension switches on the board that controlled all the high-tension apparatus were in the off position, and the locking pins were all in position, and all generators were shut down. But the switches which were out did not control the cable which made a solid connection between one terminal on the switch board and the generator. This terminal could not be made dead unless the engine was standing or running at a very slow speed. After the accident witness placed himself in the same position as the deceased was said to be in, and he found his forearm rested on a bent wire and his wrist touched the terminal of the cable connected direct to the generator, which would be a live cable to a greater or lesser degree according to the speed of the engine. On examination of the body witness found on the left wrist six or eight lines about a quarter of an inch long exactly corresponding with the screw thread of the terminal.

From 12,000 to 116,000 KW.—The Ashley Street plant of the Union Electric Light and Power Co., St. Louis, Mo., was originally laid out to house only three 3,000-KW. and two 1,500-KW. cross-compound vertical Corliss units, aggregating 12,000 KW. Upon completion of work now in progress there will be installed between the same four walls three 20,000-KW. horizontal, four 12,000-KW. vertical, and two 4,000-KW. horizontal turbines, or a total capacity of 116,000 KW.—*Electrical World.*

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Thursday last week Mr. G. L. Addenbrooke delivered the third and last of his lectures on dielectrics. Dealing with tests on mineral oils, he showed that the phenomena were generally similar to those observed in the case of blotting paper; the curve of losses was much flatter, but the apparent watts curve bent over at a low frequency and became practically proportional to the frequency. On drying the oil, the power input became directly proportional to the frequency, the losses being negligible; the true dielectric constant thus obtained was about half that given in the usual tables. The various actions observed could now be isolated from one another over the whole range of frequency.

In the case of glass, as in others, the capacity increased with frequency; at low frequencies the dielectric coefficient was higher than at high frequencies, and the coefficient decreased with the temperature, becoming constant at very low temperatures. In the case of celluloid the moisture could be dried out, but in the case of glass the material that caused the change in the coefficient remained in it. Much work remained to be done on the effects of temperature variation. The change of capacity with temperature of dried celluloid was small, but when the celluloid was not dried there were considerable changes with both frequency and temperature, and the temperature coefficient at zero frequency was much greater than at 200 cycles/sec. Celluloid was a typical subject for experiment. He had made a special glass cupboard in which experiments could be carried on whilst the humidity of the air was under control, and thus the changes of moisture content in the celluloid could be actually weighed; the results of these tests showed no trace of any "mass" action apart from the effects due to the moisture.

The D.C. and A.C. losses, as well as the changes in capacity, increased with the proportion of moisture present, and the A.C. losses were practically a measure of the moisture, a fact which would be of use in cable manufacture, as the moisture present could be determined at every stage by electrical observations. Cable breakdowns were due to moisture, not as a rule due to defects in the materials used.

It was difficult to apply similar tests to oil, but a method had been proposed by which the moisture content of oil could be determined.

The temperature effects, which were very large, might be accounted for by the vapour tension of water, which varied largely at similar temperatures.

He believed that he had obtained a new series of dielectric constants, free from the effects of the losses, which were included in the values given in tables at present. These true constants showed a definite relationship with the densities and atomic weights of the elements.

In conclusion, Mr. Addenbrooke outlined a theory of capacity effects based on the electron hypothesis, and gave reasons for supposing that the moisture in a dielectric was diffused throughout its substance.

On Monday last the first of the "informal meetings" of the Institution took place, at the rooms of the Chartered Institute of Patent Agents. The proceedings were opened by Mr. C. H. Wordingham, Pres.I.E.E., who took the chair at the commencement, and briefly explained the objects which the Council had in view in arranging for the meetings to be held; he pointed out that while they were intended specially to serve the interests of the junior members, they were, nevertheless, meetings of the Institution, and should be conducted in accordance with its traditions. Mr. F. Pooley then read a paper on questions relating to Trade Unionism, though, he said, it dealt rather with

the relations between Capital and Labour. Reviewing the history of the subject, he remarked that in the early days many employers treated their workers badly; strikes took place only under great provocation, and entailed great suffering. Nowadays the workers had combined and had discovered their strength—they had strike funds, and were shielded by the law, which had been loaded in their favour by politicians who were now reaping the fruits of their class legislation and the preaching of class hatred. The unrest of the present day, in his opinion, was largely due to nervous war strain on the part of both employers and workers; there was also a persistent lack of confidence between them, and the shop-steward system of control introduced additional difficulties. Production was essential to the restoration of prosperity, and the greatest need of the time was an effective propaganda, explaining to the workers the evils of restriction of output, the elements of economics, and the necessity for co-operation. He placed great reliance on the prominent labour leaders, and suggested that they should be granted statutory authority to deal with labour questions, while provision should be made for attaching Trade Union funds in order to compel adherence to agreements. Strikes should be made illegal unless every other resource had been exhausted.

Mr. Wordingham complimented Mr. Pooley on his able address, and after an interval for refreshments an interesting discussion followed, to which Messrs. Rankin (chairman), Paul, Law, Dickinson, and Oswald contributed; the proceedings closed at 9.40 p.m.

It was announced that on the afternoons of the days on which future informal meetings would be held, visits to works would take place, the first being to the Osram Lamp Works. Those desirous of taking part in the visits should communicate with the Secretary as soon as possible.

In the current issue of the *Journal* particulars are given of the arrangements which have been made by the Council for the administration of the Paul Scholarship for post-graduate work on the development of ways and means for electrical measurements, based on the gift of £500 by Mr. R. W. Paul. A Committee has been appointed to make the awards.

The Council has appointed Mr. W. Elsdon Dew to be the Local Hon. Secretary and Treasurer of the Institution for the Transvaal, in place of the late Mr. J. Hubert Davies.

A Committee has been appointed to arrange for sectional meetings for the reading and discussion of papers on Wireless Telegraphy. The members of the Committee, in addition to the President, are Major E. A. Barker, Mr. C. Bright, Dr. W. H. Eccles, Prof. G. W. O. Howe, Mr. W. Judd, Prof. E. W. Marchant, Major J. Erskine-Murray, Capt. H. R. Sankey, Mr. J. Sayers, Major T. V. Smith, Mr. A. A. Campbell-Swinton, Mr. J. E. Taylor, and representatives of the Admiralty, Air Ministry, and War Office.

A preliminary Committee is engaged in drawing up a draft Memorandum and Articles of Association for a proposed Society of Radiographers, to ensure that only adequately trained radiographers are employed in electromedical work, and to promote the science and practice of Radiography. The Committee comprises Mr. C. H. Wordingham, Mr. J. S. Highfield, Mr. A. A. Campbell-Swinton, and Dr. R. M. Walmsley, nominated by the Institution; Dr. R. Knox, Dr. C. R. C. Lyster, Dr. S. Melville, and Dr. F. Hernaman-Johnson, nominated by the British Association of Radiologists and Physiotherapists; and the following radiographers:—Messrs. F. E. Doran, G. F. Westlake, H. Henry, and W. Turner.

The twelfth list of the Roll of Honour of the Institution appears in the *Journal* for February.

Diesel Engine Users' Association.—Further additions to the membership of the Association were announced at the meeting held this month. Notice was given that at an early meeting a paper was to be read by Mr. Geoffrey Porter on the subject of engine wear, the discussion of which should prove to be useful and instructive. Owing to his serious illness, Mr. C. T. Bullough was prevented from stating his experience in connection with his system of electrically heating tar-oil fuel. An interesting announcement was the formation of a French Association of Manufacturers and Users of Internal Combustion Engines, and the suggestion that the two Associations should co-operate in promoting the interests of users and manufacturers of heavy-oil engines. The subject of the allowance for depreciation in connection with income-tax assessment purposes for Diesel and semi-Diesel engines is again receiving the attention of the Committee. A discussion took place on the definitions of Diesel and semi-Diesel engines respectively. Draft definitions were submitted, with suggestions and proposed modifications.

Chief Technical Assistants' Association.—The annual general meeting of the above Association was held on the 8th inst. The retiring chairman, Mr. H. F. J. Thompson (Battersea), reviewing the work of the past year, referred to the kindly assistance of Mr. C. H. Wordingham, C.B.E., President I.E.E., in bringing the C.T.A.A. and the E.P.E.A. together, with the result that the members of the former decided to join the latter for protective purposes. An eminent engineer—one who always had the welfare of the assistants at heart—had told him that it would be in the interests of all concerned, if these sectional organisations would band together and form one large protective association, but it must be done quickly. Mr. Thompson hoped that all engineers, of whatever rank, would follow that advice, and join the E.P.E.A. He regretted he had not permission to publish the name of the engineer referred to, because, if he could, he was sure that it would result in the enrolment of a number of engineers who, for some reason not quite understandable, were holding aloof, to the detriment of themselves and others. The main object of the C.T.A.A. was to hold debates on subjects directly connected with electricity supply, and some very useful papers had been read and discussed during the past year.

The new chairman, Mr. J. H. Parker (vice-president E.P.E.A.), referred to the good work done by Mr. Thompson in advising the members to join the E.P.E.A. In the near future, he said, many occasions would arise in which unity would be essential to safeguard their interests, and therefore he trusted that all electricity supply engineers would get together at once and, if the E.P.E.A. did not come up to their ideals, endeavour to make it so. He also mentioned the good work done by Mr. MacAlister as hon. secretary, since the formation of the C.T.A.A. some six years ago; he was sorry to hear he was relinquishing that office, but he had a good successor in Mr. Thompson, who, together with Mr. MacAlister, was responsible for the formation of the C.T.A.A. The following officers were elected for the ensuing year:—Chairman, Mr. J. H. Parker (Croydon); vice-chairman, Mr. A. P. MacAlister (Islington); hon. secretary, Mr. H. F. J. Thompson (Battersea); executive committee, Mr. J. T. Baron (St. Pancras), Mr. W. Young (Stepney), Mr. E. R. Ingram (Poplar).

The Institution of Automobile Engineers.—The ninth meeting of the session will be held on Wednesday, April 2nd, at the Royal Society of Arts, at 8 p.m., when Mr. Carl Opperman will read a paper on "Electric Vehicles." Cards of invitation to the meeting may be obtained by those interested in the subject on application to the Secretary of the Institution of Automobile Engineers, 28, Victoria Street, London, S.W. 1. A further meeting will also be held at the Chamber of Commerce Hall, New Street, Birmingham, on the following day, viz., Thursday, April 3rd, at 7.30 p.m., when Capt. G. Smith-Clarke will read a paper entitled "Some Notes on Petrol Flowmeters and the Calibration of Carburettor Jets." Cards of invitation to this meeting may also be obtained as above.

High-Speed Steel.—At a meeting of the Allen West Engineering Society, held at the Brighton Technical College, a lecture was delivered by Mr. T. Shawcross, manager of the Crucible Steel Department of Messrs. Armstrong, Whitworth & Co., Ltd., on the present-day development and practical application of high-speed steel. There was an attendance of about 250. Mr. Shawcross described, with the aid of lantern slides and exhibits, exactly how high-speed tool steel had been developed to its present pitch of perfection; how it was made, and how it should be used. The feature of the lecture was the introduction for the first time to British engineers of a new hardening process for high-speed tool steel. This new treatment aroused the greatest interest, and will be of the first importance to British engineering shops.

Electric Welding.—The possibilities of electric welding as a commercial proposition were dealt with by Mr. H. W. Wolton in an address to the members of the Birmingham and District Electric Club, on March 8th. The system of electric welding, he pointed out, might be divided into arc welding and resistance welding. The amount of work accomplished by the former in factories during the period of hostilities covered a very wide field. The bodies of the majority of the submarine mines had been welded together by this means, and it had also enabled damaged warships to be repaired very quickly. The majority of steel tires and rims for the Army transport departments were electrically welded during the war. One firm supplied approximately two million rims of various sections for the Allied Armies, the whole of which were welded by the resistance method.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Southampton Electricity Committee has received the resignation of Mr. H. L. Mills, for many years deputy electrical engineer. Mr. Mills has served throughout the war in the Navy, and has decided to remain afloat.

Mr. Benjamin Hall, assistant borough electrical engineer and tramways manager at Keighley, has been appointed rolling stock superintendent and works manager and engineer to the Wigan Corporation Tramway Department, at £250 a year, rising to £300.

Mr. S. L. Pearce, chief engineer and manager of the Manchester Corporation electricity works, received the order of the C.B.E. from the King at Buckingham Palace, last week.

Mr. George Webster, general manager, Rochdale Corporation trams, was invested with the O.B.E. Order by the King last week, in recognition of the war work he performed in connection with the National Shell Factory, Rochdale.

Bradford City Council has authorised the Electricity Committee to enter into an arrangement with Mr. J. H. Shaw, the deputy city electrical engineer, for the retention of his services, part time, for a period of twelve months from April 1st next, on terms to be agreed, not exceeding half the amount of his present remuneration.

Major H. Richardson, M.C., has now been demobilised, and has taken up his duties as general manager and engineer of the Dundee electric supply department. Major Richardson resigned his commission in the local engineers a few months before the outbreak of war, and applied to be reinstated immediately war broke out. He was gazetted to his old company, and after a period of training, proceeded to France

in June, 1915. He has been continuously on active service from that date until last week.

With reference to a notice appearing in our last issue regarding appointments at Bo'ness and Musselburgh, we should state that Mr. McCulloch has been appointed chief assistant to Mr. H. C. Babb, and is resident in Bo'ness, but Mr. Babb still retains the position of engineer and manager to the Bo'ness electric power station, which is run by the National Electric Construction Co. Mr. Babb is at the same time engineer and manager to the Musselburgh and District Electric Light and Traction Co.

Mr. S. Cameron Gibson has resumed his duties as borough electrical engineer and manager of the electricity department at Nuneaton, having now been demobilised from the Navy.

General.—To mark the return from war work in the fuse shop to meter work, the employés of Messrs. Ferranti, Ltd., electrical engineers, Hollinwood, Manchester, to the number of about 500, enjoyed a fancy dress masked ball last week. The guests included Mr. and Mrs. Ferranti and Capt. Ferranti. A presentation of a timepiece, constructed as a model of a Ferranti electrical meter, was made to Mrs. Ferranti, and a miniature model of a Ferranti power transformer was presented to Mr. Ferranti.

Mr. E. Brian, of Morecambe, has been appointed chief electrical engineer to the Idris Hydraulic Tin Co. in the Ipoh Province of Perak, F.M.S.

Mr. C. Martin, who has been connected with the British Westinghouse Co.'s turbine business for the past nine years, has resigned, and is now representing Fraser & Chalmers Engineering Works (proprietors, the General Electric Co., Ltd.) at Electricity Buildings, Victoria Bridge, Manchester.

Capt. S. R. Mullard, M.B.E., for many years connected with the lamp manufacturing side of the Ediswan Co., has been demobilised from the R.A.F., and has joined the "Z" Electric Lamp Manufacturing Co., Ltd., of Southfields, as works manager.

Capt. and Acting-Major G. Hooper, Devon Fortress Engineers (Electric Lights Company), has relinquished his acting field rank on ceasing to be employed. Capt. Hooper is the senior captain of the Electric Lights Companies of the Territorial Engineers, his commission being dated April, 1908, and he held acting field rank from July, 1915.

Lieutenant C. J. Evans, Glamorgan Fortress Engineers (Electric Light Company), has been granted the acting rank of captain whilst employed in the command of a company, and Lieut. and Acting-Captain H. K. Benson, of the same corps, has relinquished his acting rank on alteration in posting.

Second Lieutenant C. S. Wait, Tyne Electrical Engineers, has been promoted lieutenant after eighteen months' service.

Lieutenant and Acting-Captain N. Mansfield, Hants Fortress Engineers (Electric Light Company), has relinquished his acting rank. Lieutenant W. D. G. Wilson, Essex Fortress Engineers (Electric Light Company), has been given the acting rank of captain whilst commanding a company.

On Friday evening last, at the Holborn Restaurant, a dinner was given by the sales organisation of the Western Electric Co., Ltd., North Woolwich, in honour of Mr. H. M. Pease, the late sales manager, who has now been appointed managing director. All the branch office managers were present, and a very enjoyable evening was spent under the chairmanship of Mr. A. T. Turney. The toast "Our Guest" was proposed by Mr F. K. Jewson and seconded by Mr. H. H. Markham. The musical items which followed were exceedingly good. The evening was concluded with a presentation to Mr. Pease from the sales staff.

Mr. C. J. Butterworth has been appointed assistant to Messrs. Stevenson & McGuffie, consulting engineers, Glasgow.

Roll of Honour.—Driver W. Collier, R.G.A., who has died whilst with the Army of Occupation in Germany, was employed on the clerical staff of the British Westinghouse Co., Ltd., Trafford Park.

Obituary.—Mr. C. W. Salter.—The death has taken place from pneumonia, at the age of 24 years, of Mr. Charles William Salter, assistant installation inspector for the South Staffs. & Worcestershire Electric Power Co.

Mr. G. H. Mann.—The death occurred, on March 10th, at Leeds, of Mr. George Henry Mann, aged 31, head of the wireless department at the Leeds Central Technical School.

Mr. E. W. Crosland.—The death has occurred at the age of 42 years of Mr. E. W. Crosland, assistant works manager of the British Insulated & Helsby Cables, Ltd., Helsby.

Will.—Lieut.-Col. E. Matthey, C.B.—The late Lieut.-Col. E. Matthey, C.B. (Johnson, Matthey & Co.), left £346,748.

CITY NOTES.

British L. M. Ericsson Manufacturing Co., Ltd.

In his speech at the annual meeting, held in London on March 12th, Mr. W. M. Crowe (chairman and managing director) said that early last year, at the urgent request of the Post Office, they gave up the manufacture of munitions, and put their whole energies on the production of telephone material for the Front, and such a change over could not be done without loss of time, and consequently of money. This turnover had helped them in the end, as they were, when the armistice was signed, working on their legitimate business—telephone work—and this had certainly given them some advantage now. The result was a satisfactory one. Since they met last year they had, at the request of the Government, increased their works considerably, and it was their intention as soon as circumstances permitted, and the time was suitable, to extend still further. They felt that the coming demand for telephone material throughout the world justified such a course, and they were looking forward to a busy time. As they knew, the company was not heavily capitalised, and it might be necessary, in order to finance the proposed extensions and those just completed, to make in the near future a considerable increase in the capital, but they had not yet decided what form that increase would take. The raising of fresh capital might not have been necessary in their case had it not been for the large claims made by the Government for excess profits duty. That duty was simply eating at the vitals of the manufacturing concerns of the country—particularly those companies which had a desire to take advantage of the present splendid opportunities for extending their business. It was to be sincerely hoped that the Government would make some reduction in the duty at an early date, and that it might soon be given up entirely. There were reports of some such course being taken, but the fear was that some other form of taxation, which might be even more harmful than the present tax, would take its place. If some reduction or change for the better was not made it must be expected that foreign competition would be a serious menace to an opportunity such as the country had never had, and might never have again, and if that opportunity was allowed to slip they would certainly not get the same chance again. It was a well-known fact that the new nations of Europe, which were being created chiefly by the help of England, would like to come to this country for their supplies of goods of almost every kind, rather than go elsewhere. Formerly those countries were practically supplied entirely by Germany, and if we could not supply them now they would go where they could be supplied. They must have the goods, wherever they came from. It might perhaps be thought, and he had heard it stated, that those same new nations were so poor that their trade was not worth cultivating, but such a thought, if carried into practice, would be a fatal mistake, as they were, with proper government, nations which would soon recover and make good; and not only the new nations, but also the nations (other than Germany) which a few months ago were our enemies and were in arms against us. Those nations were now almost as much at enmity with Germany as we were, and would welcome British enterprises to their countries. That was an immense question, covering every department of trade, and including almost every country in the world, and particularly those countries which Germany practically held in the hollow of her hand. The fear was that our chances of grappling with this great trade would be, to a large extent, nipped in the bud if the handicap of the excess profits duty or other such tax was to continue. Another menace to the fine prospects before us as a nation was the instability of labour, which apparently could not be depended on for a week on end; indeed, scarcely a day passed without some fresh claim or threat being put forward. Only a few weeks ago almost every business in the country was affected through the caprice of a comparatively small number of hot-heads who, against their own party leaders, and on a paltry question, called out thousands of workers, the great majority of whom would much rather have been getting on with their work. That same thing had taken place again and again, and at the present moment was more threatening than ever, and if it continued the fine prospects before us were to go elsewhere, and elsewhere they appeared to be already going, since they heard of one big firm clearing out in disgust from Glasgow and settling in Vancouver. He, for one, did not wonder at it. In another case reported in the newspapers, the Agent-General of one of our Colonies sent orders for £750,000 value to the States because of the instability of labour in this country. Then the reports of the activities of the Americans in European, South American, Asiatic, and in our own colonial countries, showed that they had got the start of us, and they were to increase that start, if we were to go on fighting among ourselves. The Labour plea of "Not enough work to go round" as a reason for shorter hours was, under present prospects, surely a weak plea. This country, as they had seen, had the chance of taking over a large proportion of the trade formerly held by Germany, in addition to our own former trade, and the fact that the whole world was crying for goods of every kind was enough to show that such a plea was only an excuse for making trouble. Not only should there be enough work for all, but enough for years to come if labour worked day and night. At the present moment it was almost impossible to get work of any kind done. House repairing or decorating, clothing, car repairs—indeed, any class of work—they found impossible because of the shortage of labour. It appeared to him that something must be done—and that immediately—to remedy the present state of unrest, and one way would be for the workers to get an interest in the output results of their respective firms. He was glad, therefore, that the Government had appointed a committee to look into the question of a general all-round scheme of profit-sharing, or, what would be still better, a bonus on output, whereby every manufacturing concern in the country would be put

on an equal footing—namely, that there should either be a certain percentage of the profits set aside for the workpeople and divided up according to wages, or in some other equitable way, or a scheme or schemes of payment on output results which should be settled and paid monthly. By such schemes the workers would know that every ounce of energy they put into their work was helping their own pockets, as well as the pockets of their employers, and the pocket of the country generally. Several companies already had such a scheme, and they had a limited scheme working at their factory at Beeston; but he thought it would be equitable and fair if it were made general and compulsory, so that one firm would have no advantage over another. His own opinion was that the better way, and a way more satisfactory to the workers, would be a graduated scale of payments by results depending on the output, and an increasing rate for every increase of output. What the country wanted was output, output, and again output, and if they were to seize on to the opportunities now before them it was first of all output they wanted. Trade bred trade, and output bred output, and the more they turned out the more would be required. The cry of "Not enough work to go round" was absolute nonsense. What they wanted was rivalry among the workers, and they should be paid according to their ability to turn out work, so that the best men should get what they deserved, and the slacker or incapable what he deserved. Why should a man with ability to earn big wages be handicapped by the slacker? And that was in reality what was being encouraged under present rules. The whole trade of the country was suffering by such rules. Did the workers or their Unions realise what they were doing? Only the other day he heard of a case where several British firms and one American firm were asked to quote for certain material. The British firms were within £50 of each other on a £4,000 job, which proved that their prices were in accordance with current costs for material and labour. The American firm took the order at £900 less than the lowest British offer. Then it was stated only last week, before the Coal Commission, that steel was being offered by American producers at prices considerably below the present cost of production in this country, and still the British workmen were crying for shorter hours, which meant smaller output and greater cost, also for greatly increased wages. Those cases, and many others, proved that the cost in this country was already too high, and he was afraid that Labour would realise the fact when it was too late. He trusted, therefore, that the Government would take the question seriously into consideration. Why should we as a country play directly into the hands of America and Japan? And this was what was likely to happen if Labour, and he was afraid Capital as well, had not some consideration and moderation.

Bruce Peebles and Co., Ltd.

At the annual meeting, on March 14th, the chairman, Mr. F. E. Andrews, said that now that the war was virtually over, he might state that not very long after it started they rearranged one of their shops for shell work, and by some small additions to the buildings and appreciable additions to the machine tools, were able, practically solely with female labour, to turn out every month with regularity a large number of high explosive shells. Apart from this they had been engaged since the early days of the war on great quantities of parts for aeroplanes, and subsequently on various parts for tanks. They had also done a considerable amount of work for the Admiralty—especially hydrophones. Their main output had, however, all along been electrical machinery of all classes, for which there had been urgent demand for all the extensions and new works which had been built during the last four years. They had no very great upheaval to grapple with in their shops in turning over from war to peace conditions. In the past a large proportion of their output of electrical plant had been destined for export. They had always paid special attention to this part of their trade. During the war this export business had been almost impossible, and had practically disappeared, but it was their intention to cultivate it even more assiduously in the future than in the past, and although they had great competition to meet, no doubt they would achieve their purpose and obtain their fair share of orders, not only in the Colonies and Dominions, but also in the foreign countries in which they were represented. For a long time they had been at considerable disadvantage in the works owing to the want of better facilities for constructing the heavier class of machinery, the demand for which had been increasing rapidly. Their large new shop was now finished and able to relieve the congestion in the main building and deal satisfactorily with the hydraulic engineering work which they took up two years ago. They had always been very desirous of adding some special branch of mechanical engineering, so as not to be entirely dependent on electrical work; therefore, when this was brought to their notice by their colleague, Sir John Cowan, they gladly availed themselves of the opportunity. The new department had quite realised their expectations. It had already made a fair profit, and would add to the general stability of the company. The speaker went on to refer to the reorganisation of capital account. The scheme of arrangement was duly confirmed by the Court, and effect was given to it in the balance sheet. Owing to the conditions that had prevailed in the electrical manufacturing industry, and to the fact that in 1914 the company were only just emerging from their difficulties, they had a bad pre-war standard, and consequently had been, and were, hard hit by the munitions levy and excess profits duty. They were not in a position to consider the payment of a dividend on the ordinary shares; it was impossible to do so until the Government decided on its policy, and the whole question of war taxation on industry was cleared up.

Vickers, Ltd.

On Monday next, at the River Don Works, Sheffield, there will be put before an extraordinary general meeting of this company several resolutions under which it is proposed to increase the capital to £26,500,000 by the creation of 6,000,000 new ordinary shares of £1 each and 7,000,000 cumulative preference shares of £1 each. The company has issued a circular explaining that the main object of the resolutions is to place the company in a position to give effect to an offer which has recently been made to the Metropolitan Carriage, Wagon & Finance Co., Ltd., to purchase shares in that company in exchange for shares in Vickers, Ltd., or in the alternative for cash. The circular reads:—

"The chief reason for proposing this arrangement is the fact that the relations of Vickers, Ltd., with the Metropolitan Co. are already so closely linked that it is very desirable, and, indeed, almost essential, in the best interests of the two companies and of the trade of the country as a whole, that the two undertakings should come under one control, so as to realise to the full the obvious advantages of joint working and sales organisation. The two companies have very large common interests, not only in the British Westinghouse Electric & Manufacturing Co., Ltd., but also in other electrical and engineering undertakings.

"The terms on which it is proposed that the transaction should be carried out are that the shares of the Metropolitan Co. should be transferred in exchange for ordinary shares in Vickers, Ltd., and shares of the proposed new cumulative preference issue in the following ratio:—

For each ordinary share of the Metropolitan Co. 1½ ordinary shares and 2 new preference shares of £1 each in Vickers, Ltd.

For each "A" preference share of the Metropolitan Co. 1 new preference share in Vickers, Ltd.

For each "B" preference share of the Metropolitan Co. 1½ new preference shares in Vickers, Ltd.

"The offer includes an option to the holders of the shares of the Metropolitan Co. to receive cash instead of shares of the Vickers Co. at the rate of 95s. for each Metropolitan ordinary share, 20s. for each "A" preference share, and 22s. 6d. for each "B" preference share. It is a condition of the offer that it is accepted by holders of not less than 75 per cent. of the Metropolitan ordinary shares. It is expected that the shareholders of the Metropolitan Co. will to a large extent elect to receive the shares of the Vickers Co., but in view of the option given to them to take cash, provisional arrangements have been made for underwriting the whole of the proposed new issues at a commission of 4 per cent. on the price. The directors have decided to give the shareholders of Vickers, Ltd., the opportunity of subscribing for so much of the new capital as may not be taken in exchange by the ordinary shareholders of the Metropolitan Co., at the price of 95s. for the block of 1½ ordinary and 2 new preference shares. Treasury permission has been given for the issue of 7,000,000 £1 cumulative preference shares and 5,100,000 £1 ordinary shares necessary for carrying out the purchase. Four of the directors of the Metropolitan Co. will join the Vickers Board."

Metropolitan Electric Supply Co., Ltd.

At the annual meeting, on March 11th, the chairman said that the revenue from sale of current increased by 9 per cent., and the units sold by 6 per cent. The increase in revenue was due to the increases which they had made in conjunction with all other electric supply undertakings to meet enhanced costs. They had taken the opportunity to standardise further the rates for the different classes of lighting, heating, and power. Progress had on the whole been satisfactory. Since the close of the year the units generated had shown some decrease, but the weekly figures showed that this was being gradually made up. If the present labour unrest was settled in a conciliatory manner and industry was permitted to produce with the same intensity on behalf of peace as in the war-time, the demand for electricity would quickly overcome the temporary decrease consequent upon the change-over, and would be limited only by the capacity to supply. Their distribution system in the western area was already fully loaded, and if they were to meet next winter's demand they would have to spend substantial capital on main-laying, and probably on the installation of further plant at Willesden. Costs of production increased by £18,000 with fewer units generated. The principal increase in coal prices only came in the second half of the year. The coal position had caused them considerable anxiety, but the strenuous efforts of the executive had prevented any temporary diminution of supply. He hoped that as a result of the Commission now sitting the apparent impasse would be bridged over: if not there would be a national calamity by which every industry and individual must necessarily suffer. In referring to the advances in wages and in the salaries of technical staffs, the speaker said that these awards and agreements increased the costs, and the customer must realise that the companies must make some corresponding increase in the charge for electricity. He would suggest to the working-man that he should be satisfied with the hours which had now been granted, and the rates of pay which had

been agreed, and settle down to give the corresponding value in the work, so that British industry might prove that it could hold and enlarge its place in the industry of the world. It was only by the means of greater productivity and saving that the condition of the working man could be improved, and he should seriously consider the effect of further demands which might cripple, or at least retard, the development of industry, and which, if conceded, would have the immediate boomerang effect of causing increase of unemployment and the consequent lowering of wages. The principal capital expenditure of the year was for the new Babcock boilers and the foundations for the new 4,000-kw. turbine which was about to be installed at Willesden. The accounts of the Uxbridge & District Co. made a very satisfactory showing. There was a dividend on the ordinary shares, and the prospects were good. It would undoubtedly prove a valuable adjunct to the company's development in its western area, which was one of considerable promise. In discussing the Government electricity supply scheme, the chairman said that, whatever might happen, it was almost unavoidable that London must be treated as an area by itself, as the problem was a special one, and it was quite a moot point whether it would not be better for the municipal enterprises on the one hand and the supply companies on the other to amalgamate their interests under two separate bodies or boards, controlling and administering the districts which they at present supplied, inter-connected where necessary, so that bulk supply, as and when required, could be given by one to the other. In this matter the London companies were acting in concert. One of their directors, Mr. George Balfour, was a member of the House of Commons. The speaker paid a tribute to the splendid services of the general manager, Capt. Rendell, the chief engineer, Mr. Markby, and the secretary, Mr. Hipwell.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The connections at the end of 1918 were 309,051 h.p., an increase of 11,972 h.p. The profit was £342,394, against £309,779. There is carried to reserve for plant renewals and improvements £40,000, as against £60,000. Including £8,468 brought forward, £310,862 is available, against £257,214 last year. Debenture and loan interest absorbs £75,611, and there is put to reserve for special depreciation and contingencies other than the equalisation of dividends, £60,000. The preference dividend of 5 per cent. requires £62,364, and the ordinary dividend of 8 per cent., subject to tax (as last year), £69,458. There is to be carried forward £41,428, against £8,468 brought in. It has been considered advisable in view of present conditions to carry forward a larger amount to the current year, to be allocated later as may be found necessary. £28,740 expended on renewals and improvements during 1918 has been charged against reserve for plant renewals and improvements account. The reserve for special depreciation and contingencies stands at £350,245, after charging the costs and expenses of the issue of shares made by the company in October last and of the issue of shares and debentures of the Tees Power Station Co., Ltd. The revenue of the year was adversely affected by the general dislocation of trade in the district which followed the cessation of hostilities. The additional capital expenditure for the year was £467,169, and represented further extensions at Carville and Dunston power stations and of the company's distribution system. The issue of 500,000 ordinary shares of £1 each offered to the public at a premium of 6d. per share was largely over-subscribed. Preferential allotments were made to the shareholders who applied. Mr. A. Bonnin, of Newcastle, has been appointed a director. Annual meeting: March 25th.

Notting Hill Electric Lighting Co., Ltd.

At the annual meeting, on March 11th, Mr. A. E. Franklin said that though the revenue increased £1,340, the gross profit showed a reduction of £4,254, largely due to the extra cost of labour. The rate of wages had increased between 100 and 200 per cent. during the war, and there was now no man in the company's employ who received less than £2 per week above his wages in 1914. The price to the consumer was raised to 7d. from the March quarter, and to 8d. during the last quarter of the year. With this, but for the Household Fuel and Lighting Order, the accounts would have shown a result equivalent to former years. If the order was removed in the near future the output should increase sufficiently to meet the additional cost of production, but he could not speak with any certainty in view of the doubtful position with regard to the cost of coal and labour generally. The chairman referred to the threatened strike at London power stations as follows:—

> At the last moment the Government announced that the same protection would be given to users of electric current as to those of water and gas. Still, even had a strike been attempted, I believe it would have been possible for us to have carried out our obligation to the public, and to have continued the supply of electricity. At practically all the generating stations in the Metropolis the workmen were quite loyal to their employers, and it is very doubtful whether they would have come out. The majority of the men belonging to the Union which proposed to order the strike are engaged in wiring and other classes of employment for private contractors, and are not connected with generating stations. It would seem, therefore, utterly illogical that through their majority in the Union these outsiders should be able to shut down the whole of the electric supply to London when the workmen employed in providing it were quite content to continue their occupation. We have posted a notice in our works expressing our appreciation of the loyalty of our men in refusing to be coerced into what is pronounced by the Government to be illegal proceedings.

The company's capital of £200,000 was divided amongst 416 holders, and the average amount distributed per annum to each holder was £27, which would be reduced to £24 per holder if the insurance companies were eliminated, less than 10s. a week apiece.

Automatic Telephone Manufacturing Co., Ltd.—Supplementing our brief reference of last week, the report for 1918 states that the profit was £43,781, plus £11,550 brought forward. Directors' fees, £2,450; depreciation on patents, goodwill, buildings, plant and machinery, £8,000; preference dividend, £12,000; dividend of 6 per cent. (less tax) on the ordinary shares, £21,600; carry forward, £11,282. During the first part of 1918 the company continued to supply the Government with considerable quantities of munitions of war, but about the middle of the year orders dropped off, and arrangements had to be made for the cessation of munition supplies and the reorganisation of the factory for the resumption of normal business. This has caused the company considerable loss of time and money. The company has on its books a fairly satisfactory number of orders for telegraph and telephone equipment which will keep the factory busily employed for some time to come. Meeting, March 24th.

British Insulated & Helsby Cables, Ltd.—According to the report for 1918, to which brief reference was made last week, the profit was £288,280, plus £84,792 brought forward. The following are deducted: Directors' and debenture trustees' fees and remuneration to works' committee, £6,280; interest on first debenture stock, £22,500; interest on second debenture stock, £10,000; preference dividend, £30,000; depreciation on buildings, plant, machinery, &c., £25,000; to reserve, £50,000; to first mortgage debenture stock redemption account, £5,000; dividend 12½ per cent. for the year on the ordinary shares (revised capital); carrying forward, after making provision for estimated liability for excess profits duties, £99,292. Whilst some departments of the works have been exceptionally busy during the past year, others have been very short of work. The capitalisation of £500,000 of reserves has been carried into effect. Meeting, March 24th.

Brompton & Kensington Electricity Supply Co., Ltd.—The revenue account shows a credit balance of £18,487 for 1918, plus £5,217 brought forward. £1,000 interest on loan to the Brompton & Kensington Accessories Co., Ltd., and other items, makes £25,093. There is put to credit of depreciation account (restoring it to £85,000) £113, to reserve fund (raising it to £62,000) £7,000, and after paying the preference dividend and 8 per cent. for the year on the ordinary shares, £2,276 remains to be carried forward. The connections increased by 18,843 (35-watt) to 402,682; customers connected increased from 6,860 to 7,013; gross receipts fell from £61,898 to £58,759; expenditure increased from £31,580 to £40,272; net receipts fell from £30,319 to £18,487; average price per unit advanced from 4.05d. to 4.13d. Dividend falls from 10 per cent. to 8 per cent.

Bournemouth & Poole Electricity Supply Co., Ltd.—Mr. J. A. Hosker, at the annual meeting on March 13th, said that the drop in dividend from 6 per cent. to 5 per cent., and the reduced carry-forward were due to the Fuel and Lighting Restrictions Order and the increased costs. The company's business was largely lighting, and its natural sources of development had been arbitrarily cut off. The increase in wages was equal to 76 per cent. for skilled, and 96 per cent. for unskilled labour. They had increased the rates to consumers by a further 5 per cent., and on January 1st, 1919, another increase of 8½ per cent. came into operation. When the restrictions were removed, as he hoped they shortly would be, there would be a great increase in the demand for current, and they would have a free hand to connect new consumers and develop the business on the usual progressive lines.

Simplex Conduits, Ltd.—The date of the ending of the financial year has been changed. No balance-sheet has been taken out in respect of the working of the company for 1918. The next report and accounts will cover the period dating from January 1st, 1918, to July 31st next. In order to bring payment of dividends into line with the new arrangement (says the *Financial Times*) an interim dividend will be paid for the seven months ended July 31st, 1918, on the ordinary shares at the rate of 20 per cent. per annum, free of tax, *pro rata* for the seven months.

British Aluminium Co., Ltd.—Profit for 1918, including amount brought forward, after making provision for excess profits taxation and tax, and after charging amounts required for service of prior lien debentures and debenture stock, £249,416. To depreciation £70,000; £70,000 to reserve fund. Final dividend on the ordinary shares at the rate of 12 per cent. per annum, making 10 per cent. for year, carrying forward £31,380.

Midland Electric Corporation for Power Distribution.—Dividend, 6 per cent. on ordinary shares for year; £5,000 to reserve; £500 to debenture stock redemption account; £4,275 written off expenses of issues of debentures and shares during construction; £11,008 for depreciation on plant, machinery, &c.; £21,989 forward, subject to excess profits duty. It is proposed to authorise an increase of the rate of dividend on the preference shares from 6 per cent. to 7 per cent. per annum.—*Financial Times.*

Direct Spanish Telegraph Co., Ltd.—Dividend 10 per cent. per annum on the pref. shares, less tax, and one of 6 per cent., free of tax, on the ordinary for the past half-year, making 5 per cent. for the year. Also a bonus of 2 per cent., free of tax, on the ordinary for the year.

Stewarts & Lloyds, Ltd.—Dividend 2s. per share and a bonus of 6d. per share on the deferred ordinary shares. £100,000 to reserve; £70,000 for depreciation and, excess profits provision; £10,000 to employés' benefit reserve; carried forward, £100,000.

Electrical and Industrial Investment Trust Co., Ltd.—A dividend of 5 per cent. is to be paid on the preferred ordinary shares and £17,183 carried forward. According to a financial paper the reserve fund has been reduced from £33,795 to £32,160.

Gateshead and District Tramways Co., Ltd.—Dividend on ordinary shares for the year 12s. per share and a bonus of 8s. per share. To special reserve £15,726. Carry forward £3,478.

Stock Exchange Notice.—The undermentioned securities have been ordered to be quoted in the Official List:—

North Metropolitan Electric Power Supply Co.—259,980 additional 6 per cent. cumulative preference shares of £1 each, fully-paid (Nos. 340,001 to 599,980).

Hastings and District Electric Tramways Co., Ltd.—Dividend 6 per cent. on preference shares. £2,000 to depreciation; £2,000 to suspense; £1,086 forward.

Manila Electric Railroad & Lighting Corporation.—A dividend of 1½ per cent. for quarter ending March 31st on common capital stock.

South Staffordshire Tramways Co., Ltd.—Dividend 4 per cent. on the preference shares.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets will be in a better frame of mind next week. Nothing is so bad for them as suspense. Hanging upon what may happen at the end of this week in the Labour world, capitalists—large, medium, small—decide to do nothing until a strike is declared or averted. The poison of uncertainty has crept through everything. Other countries are similarly tried. So even the popularity of foreigners is on the wane, and everyone says he will wait and see.

Home Railway stocks had a special and peculiar burden, above the Labour pressure, in the Parliamentary Bill for setting up a Ministry of Ways and Communications to be armed, as at first proposed, with such autocratic powers as would enable railway nationalisation to be effected on terms very different from any which anticipation has dwelt upon since Mr. Winston Churchill first casually mentioned the Government's intention to nationalise the railways in the near future. Monday night's debate on the Second Reading of the Bill has left a good deal of vagueness in the air. Metropolitans have fallen 1, Districts ½, Underground £10 shares ½, while the market in steam stocks is extremely flat.

Home electricity shares are amongst the steady markets. Surmise is busy to account for the reason why some of the companies were able to increase their dividends what time others had to reduce theirs. It is suggested that certain electric light undertakings put into force earlier than others their powers to advance the price of their current. Informed opinion may smile at this explanation: we quote it for what it may be worth. Metropolitan ordinary shares have recovered part of the dividend deducted last week. Otherwise the list is almost unchanged. Demand for Westminster 4½ per cent. preference deserves notice; the price has hardened to 4 5/16. Newcastle-on-Tyne ordinary shares are firm at 23s. 3d. on the report, showing a rise of £33,000 to £342,400 in the net earnings. The dividend is maintained at 8 per cent., but the carry-forward, £41,400, is strengthened by the amount of the extra revenue. The 5 per cent. preference are lower this week at 18s. 9d. They get an extra dividend when the ordinary shares receive over 8 per cent.

British Electric Tractions are down to 46½ for the ordinary and 79 for the preference. Manila ordinary advanced to 95½. Brazil Tractions are better at 55½. Anglo-Argentine Tramways remain weak and depressed. Mexicans are disposed to give way for lack of practical corroboration of the recent hopes that affairs will quickly take a turn for the better under pressure from the newly-appointed protection committees.

British Columbia Electric stocks have been depressed, but show a slight tendency to rally from the worst. Rio Tramways first mortgage bonds at 98 and Sao Paulos at the same price are both ½ lower.

Marconis give evidence of a duller tendency. Canadians receded to 14s. 6d., though Americans remain steady at 29s. 9d. The Eastern group is strong, Eastern Ordinary and Globes both being higher. Anglo-American preferred has improved a little.

The biggest thing of its kind ever attempted in this country is the taking over by Vickers, Ltd., of the Metropolitan Carriage, Wagon & Finance Co., Ltd., particulars of which were announced this week. When everything is completed, Vickers will have a capital of 26½ million pounds sterling. The Metropolitan Wagon Co. has a large interest, with Vickers, in British Westinghouse and in other electrical and engineering undertakings, and the amalgamation is likely to be fraught with far-reaching consequences. The immediate effect has been to bring about a fall in the price of Vickers and a rise in the Wagon shares. Other iron and steel issues are heavy in consequence of the Labour uncertainties.

British Insulated & Helsbys have given way 2s. 6d. to 2½ on the reduction in the profit from £363,000 to nearly £75,000 less. The earnings, however, are higher than any shown prior to 1915. The net profit of £224,500 is £45,000 less than that of a year ago. As already announced, the dividend is to be maintained at 12½ per cent., which is equal to the 25 per cent. distributed a year ago on half the present capital. Para Electric ordinary shares have eased off to 5½, in spite of a satisfactory meeting on Monday. Telegraph Constructions are out of the picture for the moment, but the market will be restored in the new shares as soon as the reorganisation rearrangements are complete. Callenders are ¼ lower. Otherwise, the manufacturing group is unchanged, save that Babcocks gave way sharply to 3⅜ in company with other concerns of this kind. The rubber list is quiet, with a heavy tendency, consequent upon the langour of business, and in base-metal shares there is little doing.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price March 18, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	8	7¾	—	£6 15 7
Charing Cross Ordinary	4	4	3⅝	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	3⅝	—	6 13 4
Chelsea	£5	£8	3⅝	—	4 1 1
City of London	8	8	19½	—	6 8 0
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	7	6	6	—	5 16 8
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	5	6	3½xd	—	6 13 4
Metropolitan	4	5	8¼xd	+ ¼	7 18 10
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 13 6
St. James' and Pall Mall	9	9	7⅞	—	7 0 4
South London	5	5	8	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6¾	—	6 13 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	99	+ ½	6 1 2
do. Def.	1½	83/6	21½	—	7 13 0
Chile Telephone	8	8	7⅞	—	5 6 8
Cuba Sub. Ord.	7	7	11	—	*6 7 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	161½	+ ½	*4 19 0
Globe Tel. and T. Ord.	7	7	14½xd	+2/-	*4 16 7
do. Pref.	6	6	10½xd	+3/-	5 14 8
Great Northern Tel.	22	22	32½	+ ½	6 16 6
Indo-European	13	13	58	—	5 12 0
Marconi	20	20	4¹¹/₁₆	+ 1/16	4 6 6
Oriental Telephone Ord.	10	15	3⅝	—	4 0 0
United R. Plate Tel.	8	8	7⅞	—	*5 1 7
West India and Panama	1/3	1/3	1½	—	*3 15 0
Western Telegraph	8	8	16⅝	—	*4 14 10
HOME RAILS.					
Central London Ord. Assented	4	4	63½	—	6 6 0
Metropolitan	1	1½	27	—1	4 12 7
do. District	Nil	Nil	21½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	8½	— ½	Nil
do. do. "A"	Nil	Nil	9/6	—	Nil
do. do. Income	4	5	95	—	*5 5 3
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4¾xd	—	6 11 4
Anglo-Arg. Trams. First Pref.	5½	Nil	8½	—	—
do. do. 2nd Pref.	—	—	3⅜	— ½	—
do. do. 5 Deb.	5	5	68½	—2	7 6 0
Brazil Tractions	—	—	55½	+½	—
Bombay Electric Pref.	6	6	109	—	5 11 7
British Columbia Elec. Ry. Pfce.	5	5	62½	—1	8 0 0
do. do. Preferred	Nil	Nil	44	—	Nil
do. do. Deferred	Nil	Nil	42	—	Nil
do. do. Deb.	4½	4½	61xd	—	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	69½	—2½	Nil
do. 6 per cent. Bonds	Nil	Nil	59	—	Nil
Mexican Light Common	Nil	Nil	38	—1	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	67	—2	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3⅜	— ½	4 2 9
British Aluminium Ord.	10	10	1⅛	—	5 6 8
British Insulated Ord.	25	12½	2½	— ½	5 17 8
British Westinghouse Pref.	7½	7½	2⅛	—	6 3 0
Callenders	25	25	10½	— ½	6 1 11
do. 6½ Pref.	5	6½	5¾	—	6 3 10
Castner-Kellner	25	20	3/-	—	6 1 8
Edison-Swan, "A"	—	—	19/-	—	—
do. do. 5 per cent. Deb.	4	5	74½	—	6 14 3
Electric Construction	10	10	1½	—	8 0 0
Gen. Elec. Pref.	6	6½	10½	—	6 6 10
do. Ord.	10	10	17⅝	—	*5 14 3
Henley	25	25	2⅛	—	6 8 9
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	—	—	6½	—	*3 2 0
Telegraph Con.	20	20	—	—	—

* Dividends paid free of Income Tax.

NOTES ON ELECTRICAL PRECIPITATORS.*

By ERNEST EDGAR THUM.

The Cottrell process has been a godsend to more industries than to metallurgical plant alone. Early developed as a method to mitigate nuisances and damaging fumes, it was soon found that the deposits had considerable value as by-products. The latest installations as an integral part of manufacturing processes point the way for an even greater sphere of application and usefulness. Success depends upon many different conditions, and a large number of installations are preceded by painstaking experiments to determine the best way to clear the gases of their impurities. It is extremely difficult to predict the power consumption, voltage, velocity, and temperature for correct operation until actual preliminary experimentation has been completed on the gas.

The power house should preferably be quite close alongside of the treater, with switchboard and windows so arranged that the electrician can at all times have a clear view of his assistant who operates the knocking mechanism and watches the clearance being effected. The operating platform should be strongly and thoroughly illuminated so that mutual signals may not be interrupted by darkness or foggy weather. Should such a layout be impossible for valid reasons, intercommunication can satisfactorily be maintained only by telephone; receptacles should be installed at a number of points, readily reached by short lines from operator's head-sets. By means of call bells the two partners may thus get into intimate contact without delay. As a safety-first precaution in any case, interlocked coloured lights on the circuit-opening switch at each unit should indicate whether the high-tension current on the treater is on or off.

The operation of the treater plant will be largely adjusted by the appearance of the exit gases. In many cases an excellent recovery of values is effected, although the visual clearance is poor; thus a fair visual clearance indicates a satisfactory recovery. Therefore the method is not only simple but effective. In a large installation, one man will continuously be watching the condition of the gases issuing from the treater tubes. Proper illumination should be provided so as to permit easy observation through openings glazed with acid-resistant panes, the illumination extending to all portions of the treater's interior. Observation of the gas as it issues from the tubes is most essential when the effluent is mixed with other smoke before being discharged from the chimney, or when handling hot, humid gases which condense a cloud of water particles immediately upon mixing with the colder outside air. Watching the smoke from such chimneys evidently is of limited value. In all cases a series of properly made filtration tests is the last resort to determine the actual efficiency of the electrical precipitator.

For the protection of both the man and the treater the plant should be adequately roofed—if conditions are such that a certain temperature of gas in the treater must be exceeded it may even be necessary to house it completely during the winter. Conditions which make for the comfort of the operators will in nearly every case inure to the benefit of the plant operations. Thus, in case the draught conditions are such as to require the use of a fan it should generally be placed beyond the treater so that the latter will operate as a "suction" chamber rather than a "pressure" chamber. Should the pressure inside a treater be greater than atmospheric, fume and smoke may blow out through the seams and openings—an absolutely gas-tight job would then be required. Again, after shutting off the gas previous to repairing a treater section, the atmosphere in a suction chamber may be cleared in a few minutes, much more rapidly than if it were under pressure.

If each section of the treater is connected to its individual electric supply it will be possible to operate each section independently of its neighbours, and the electrical conditions in it can be adjusted to secure the best results.

Two methods of generating energy are in vogue: First, a large A.C. generator of proper rating and design may furnish enough energy for the whole plant, but each treater section will have a separate transformer and its own rectifier driven by a quite small synchronous motor. Included in this classification is the case where an industrial circuit of large capacity supplies the transformer-rectifier-treater units. The alternative power-house layout requires a motor generator and rectifier all on one shaft, the alternating current necessary for the treater unit being generated, transformed, and rectified entirely independently of any other unit.

Experiments at Anaconda indicate that the wave-form has a determining effect upon the efficiency of precipitation. Such being the case, commercial electricity whose characteristics may be suddenly distorted by outside loads should not be rectified. However, this energy can be used to drive a single-phase generator especially designed to produce the correct wave-form.

While the first-mentioned power plant is somewhat simpler, it can be installed but little more cheaply than the second when proper induction voltage regulators are included. At most, the electrical equipment costs but 15 per cent. of the total, and it is false economy to install unsuitable machinery. Horn gaps may be used to assist in protecting the transformer insulation, set slightly further apart than the radius of the treater pipes. Ample precautions should be taken to protect all transformers, rectifiers and other equipment. Permanent series resistances in both high- and low-tension lines are effective in interrupting oscillating discharges and limiting short circuits. Condensers shunted across the generator leads are also useful in absorbing surges reflected from the transformer windings.

It is well to have all the electrical machinery of large capacity. In this relation, the preliminary investigations should determine particularly the electrical characteristics of the precipitated material, since it has been shown that the resistance of the gap between clean discharging and collecting electrodes may be lowered as much as 50 per cent. by a thin non-conducting deposit. The voltage on the system must then be lowered in order that heavy arcs may not trip the circuit breakers. Such discontinuous dielectrics retain their electrical charges and ionise the surrounding gases if the dielectric constant of the particles be large. The remedy is to make the deposit conductive by humidifying the gas or (in case corrosion is feared) by adding a conducting dust like carbon. The wave form of the rectified current, and to a less extent its voltage, is adjusted by rotating the rectifier "brushes" slightly.

Fig. 1 is a sketch of the rectifier now commonly used. It consists of a synchronously rotating disk of non-conducting fibre or composition to the edge of which are riveted the metallic quadrants A and V. Brushes *b*, *d*, *y*, and *z* are metallic horns symmetrically fixed in a movable frame.

It will be seen that as the disk rotates the quadrants A and V alternately connect the terminals *b* and *z* to brushes *d* and *t* respectively. In this manner unidirectional, intermittent current is sent to the wire electrodes in the precipitation plant. Reference to fig. 2 will give the characteristics of the current sent to the treater, where the wave is

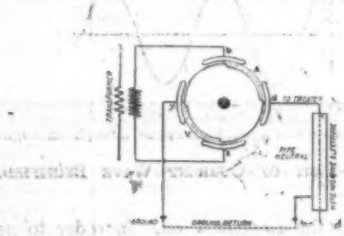


Fig. 1.—Wiring Diagram for Mechanical Rectifier.

the ordinary sine curve representing the time-voltage relations of an ideal alternating current. Segment A (fig 1) collects the troughs of the waves during a time on each side of the minima shown by dark portions of the curve, while the peaks are collected a half-period later by segment V. If all the brushes are attached to a frame capable of being rotated around the shaft, turning this frame counter-clockwise will collect the current at an earlier time on the increasing voltage wave. Fig. 3 shows the portion collected in darkened lines as before, and it is plain that each impulse starts at a relatively low voltage, rapidly increasing to the maximum, when it is interrupted. On the other hand, clockwise rotation will first catch the current nearer its crest voltage and deliver an impulse of rapidly decreasing potential (see fig. 4).

In adjusting the treater clearance it is common for the electrician to throw the brush-holder to one limit of its travel, and then move it slowly back and forth until his assistant watching the clearance signals the best location. Then the appearance of the arcing of the rectifier or the reading of a milliammeter on the high-tension line is relied upon to exhibit variation in electrical conditions in the treater. Naturally fine adjustment of these brushes is not essential, since changing conditions in the treaters demand attention from the operatives at intervals. Since the part of the current wave propelled toward the treater depends upon the potential of the crest, the width of the air gap and the length of the brushes (as well as the angular setting of the latter), it is evident that the adjustment of the position of brushes such as sketched in fig. 1 will greatly alter the characteristics of the sparking at the rectifier. The peak only may be collected, resulting in short, snappy arcs at the rectifier, or long flaming arcs may almost envelop the circumference of the disk when commutating long portions of the wave. The latter obviously transmits a greater amount of energy into the treater.

The potential wave actually existing across the electrodes is very flat, quite different from that existing at the brushes, since the treater acts like a condenser, and discharges very slowly by transport of charged particles.

* From *Chemical and Metallurgical Engineering*. Abstract.

The smelter smoke to be cleaned usually flows from a hopper to a collecting flue through upright pipes or between parallel sheets. This whole structure is earthed. The negative current is distributed to wires, chains, or thin pipes, stretched by weights or springs through these collectors and accurately centred at both ends by latticed frames. These frames, in turn, are supported by cross-beams extending through openings in the hopper and flue walls, there resting on proper insulators and protected from accidental contact by a basket or "pent-house." However, it is not desirable to depend upon air seepage to keep the dust from gradually settling on the insulators, especially in case the gas carries free sulphuric acid (as do copper converter and roaster gases).

In the latter case a treater designed to catch dry dust must operate at a temperature above that of any considerable condensation of the free acid, and any infiltering cold air would speedily deposit a tenacious acidic film upon the insulators, causing earths and punctured insulator petticoats. In such cases it has been found desirable to frame a beam into the ends of those supporting the latticed frames, which beam will extend longitudinally outside the flue walls. This longitudinal beam is then supported by insulators placed centrally some distance from the openings. The whole is enclosed by an iron box, preferably welded air tight at all joints, with weather-stripped doors of glass opposite each insulator, all as shown in sectional plan in fig. 5. An excellent precaution is to have the levers controlling the high-tension tower switch so arranged as to extend in front of

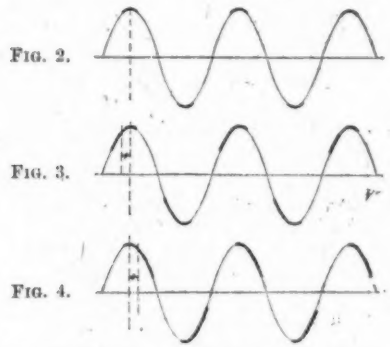


Fig. 2.—When brushes are set at theoretical point of maximum voltage.
Fig. 3.—When brushes are rotated counter-clockwise through an angle φ.
Fig. 4.—When brushes are rotated clockwise through an angle θ from theoretical position.

Figs. 2-4.—Part of Current Wave Rectified.

these doors when the current is on. In order to get into the insulator box it is then necessary for the attendant to move the switch levers, thus cutting off the current before being able to open the door.

The collecting tubes or plates, of course, should be quite clean and smooth so that no electrical leakage at shortened air gaps may occur. As precipitation proceeds, a fume deposit builds up on both pipe and wire, facilitating point-discharges and decreasing the air gap as well. In order to restore the tubes to their normal condition it is necessary to shake this dust free at intervals. Mechanical rapping may be done by hammers hung from an oscillating horizontal shaft between alternate rows of pipes striking on welded pads, and a similar hammer striking compression springs fixed on the latticed frames supporting the electrodes. The current of electricity must evidently be interrupted during shaking of the charged electrodes, and is usually stopped when rapping the collecting electrodes, but in any case the jarring mechanism should be earthed in two independent ways. All rapping is best done by power.

Whether the gas current should be interrupted during shaking depends largely upon conditions. In large sectionalised installations the provision of one complete unit in precipitator and power plant is desirable. In the case of inflammable or explosive fume it is essential that the treater be large enough that both the gas and electricity may be in disastrous fires.

The snapping discharge of spark-overs can be heard by the treater tender or located by looking into the upper flue or lower hopper. If a thorough rapping of electrodes will not stop the trouble, or if a localised arcing discharge is robbing the bulk of the tubes of their supply of electricity, it may be necessary to shut down the section, and remove the cause.

Snappy spark-overs do not affect the treater operation seriously, since they consume but little power, and the generating system and transformer are protected from the effect of the momentary short circuit by the rectifier. Localised arcing is instantly recognised by a jumping ammeter needle and heavy flames at the rectifier. Such arcs should open the circuit breakers before damage is done, or can be made to introduce a protective resistance in the low-tension circuit automatically. Wire electrodes are seldom burned off or fused, owing to the relatively low amperage of the spark-overs.

A thin non-conducting deposit, a thick conducting deposit, or a derangement of electrode spacing, may reduce the treater voltage, as already noted. In addition to this, leakage over wet or defective insulators may be very hard to locate and cause serious trouble. Again, at more than 50,000 volts stretched wire electrodes tend to vibrate in elliptical orbits on account of unbalanced attractive forces being suddenly relieved by a local arcing discharge. Damping rods or the use of chain electrodes cures this tendency—very high voltages may require rigid electrodes. A further cause of lowered voltage is the screening of the discharge due to a high concentration of dust or fume in the gas. Since the efficiency of the precipitation depends upon the maintenance of the maximum voltage in the treater, constant attention to all such points is required of the careful operator.

Properly made experiments preliminary to construction will determine the best conditions of voltage, pipe lengths, and diameter for all normal variations in temperature, composition, and velocity of the gases. It is not so easy to translate the results attained with one or a few pipes to an installation containing hundreds. Perhaps the most trying thing is the attempt to insure equal gas distribution to all the dozens of pipes in one section, especially with the low velocities desirable.

If the main intake is merely a pipe opening into the side of the dust-collecting hopper, there may be large differences in pressure in the collectors with their varying distances from the intake. In some cases the gases are discharged through a ventilator-like hood set in the centre of the hopper. Then the corner and middle pipes may suffer. The

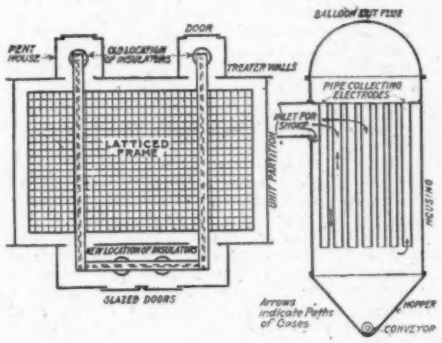


Fig. 5.—Method of Placing Insulators Distant from Openings into Body of Treater.

Fig. 6.—Sketch of Top Inlet for Uniform Gas Distribution.

design should be such as to prevent eddies as far as possible. Nearly ideal gas distribution could be provided in a vertical-pipe treater if set directly above a furnace outlet, connection between the two being made by a straight, uniformly tapering flue. Where head-room is lacking or a tall structure seems undesirable, a distribution as good as any attainable after a sharp turn may be had by introducing the gas near the top of the housing around the collecting electrodes, as sketched in fig. 6.

Even with the most perfect mechanical design, however, furnace operations vary enough to make large differences in temperature, volume, and composition of the gas to be handled. Fume-laden gases are often cooled, and at the same time their electrical conductivity and the efficiency of the precipitation bettered, by water sprays discharging into the flue leading to the precipitating plant. This last method must be used with circumspection, however, if acids are liable to be formed and collected in the precipitator. Besides the fact that a rise in temperature lowers the arcing voltage, it causes large differences in the volume of gas to be treated, and consequently its velocity through the treater.

Combustible dust should be removed from the neighbourhood of the electrical discharges as rapidly as collected. Screw or drag conveyors for this service should be made several times as strong as the designer ordinarily thinks is necessary, so that they may break up and remove the wet, caked dust remaining after a fire has been extinguished without themselves breaking.

Submerged Coal Storage.—In 1912 the Indianapolis Light and Heat Co. constructed a concrete pit to contain 13,000 tons of coal submerged. Recently the company constructed a reinforced concrete coal pit holding 8,000 tons. The two pits have a total capacity of 20,000 tons submerged and 10,000 tons of coal above the water line, giving a 60-day supply if both pits are filled. The total cost of the two pits was $60,000, or $2 per ton of storage.

The results of under-water storage have fully met the company's expectations, in that it prevented fires and preserved the heating value of the coal. Comparative tests of freshly mined coal and coal which had been stored under water for approximately one year, from the same mine and the same vein, showed that the coal had lost during storage only 317 B.TH.U. out of 12,518 B.TH.U. per ton.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Electric Welders.

Of the many advances that have come forward during the war, perhaps there has been nothing that has developed more than electric welding. An efficient line of spot, seam, and butt welders, marketed by the A.1. Manufacturing Co., Sunbridge Road, Bradford, has been engaged on a munition contract, and has given effective results. The stakes or arms of these machines can be made in varying lengths to reach into difficult positions. The machines are efficiently guarded, and the arms are thoroughly water cooled. A point about the machines is the perfect balance; even if run continuously all day, the movement of the machine is as easy at the end of the day as at the beginning. The current does not pass through any moving parts, but is conveyed direct from the transformer to the stakes by suitable flexible connections. We understand that these machines are supplied power driven, if desired, to facilitate continuous spot welding.

Fig. 1.—"A.1" No. 2 Spot Welder.

In fig. 1 we illustrate a development which is especially interesting to the hollow-ware, jewellery, and other trades, where light welding is required at high speed, and where awkward places are to be reached. The double face-plate on this machine enables the lower arm to be moved up or down, right or left, and the long water-cooled electrode in the upper arm will also be noted. This upper arm will swivel to right or left, so that the point will always be in line with the bottom electrode. Also, this upper arm can be drawn out or pushed back, so as to accommodate longer and shorter lower arms. It is claimed that a speed of 60 to 100 welds per minute on 30-gauge metal can be attained continuously.

Another feature of the machine is the trip-switch, which is entirely automatic. The pressure on the pedal causes pressure to be mechanically applied to the article. Continued pressure on the pedal turns on the current, and further pressure cuts the current off and increases the pressure on the weld. This switch can be so set that the duration of the application of the current can be regulated to a nicety.

The ordinary standard type of spot welder can be converted in a few moments to a butt welder for light work. Fig. 2 illustrates a No. 4 "A.1" system spot welder, to the arms or stakes of which suitable blocks have been fixed. It will be seen that two ¼-in. rods have been fixed in position ready for welding. This machine will spot weld up to ¼ in., or occasionally ⅜ in. in thickness. By the adjustment alluded to it is converted into a butt welder, which will efficiently weld up to ¼ in. in thickness, or by another attachment of a somewhat similar nature it can be converted into a seam welder, to weld up to ¼ in. added thickness. These features make the machine of very general utility where it is not profitable to have a special machine for each process.

The Finsbury Dolly Press.

For the manufacture of dry cells the Hillbar Press, of 76, Finsbury Pavement, E.C. 2, which specialises in battery-making machinery, has introduced the improved type of dolly machine illustrated in fig. 3. The design is the result of a great deal of experimental work, and the operation of the machine is exceedingly simple; for each three movements of the working parts a perfect dolly is obtained.

In fig. 3 A is the capstan head, which swivels about a centre and so brings the ramming tools D or E into position as required. The handle B is directly connected to a pinion which, engaging a rack on the back of slide J, enables the tools to be advanced into the mould G for the purpose of ramming.

C is the handle of the bottom traversing gear which operates the ejecting tool F. H is an adjustable stop. The machine is adaptable to any size of dolly up to Giant Torch, all that is necessary being a change of tool heads and mould.

Special sets of tools are made, in sections, so that the wear that takes place does not scrap the whole tool, but only the loose replaceable heads. Mould casting dies are also provided; one mould will last while 4,000 dollies are made, which is the daily average output of the machine.

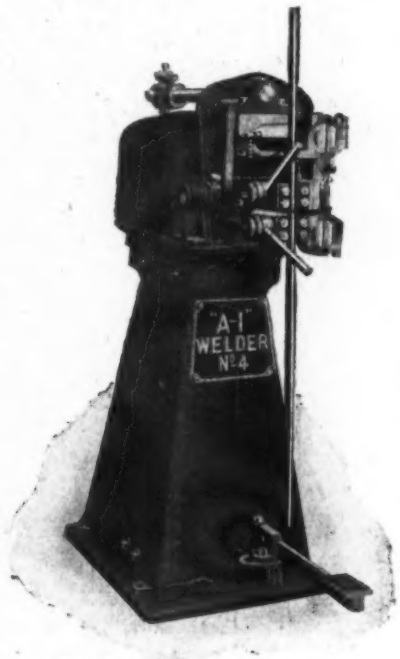


Fig. 2.—"A.1" No. 4 Convertible Spot, Butt, or Seam Welder.

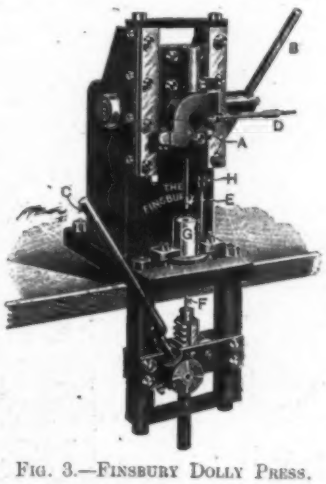


Fig. 3.—Finsbury Dolly Press.

THE DETERMINATION OF THE EFFICIENCY OF THE TURBO-ALTERNATOR.

At Manchester, on February 25th, Dr. S. F. Barclay's and Dr. S. P. Smith's paper (an abstract of which appeared in our issue of March 7th, 1919) was read and discussed before the North-Western Centre of the Institution of Electrical Engineers.

Dr. Miles Walker said that in the past end-plate, eddy-current, and open-slot features had caused very heavy losses, and it would be a great achievement if the authors threw light on them. He agreed that the method of measuring the temperature rise and the air flow was a sound one in arriving at losses; the main difficulty seemed to be in the accurate measurement of the air. The method used by the authors was, he thought, a good one, but it was open to the objection that they were not quite sure of the shape of the curve of losses. It was not easy to ascertain exactly how the curve rose, and it did really create a difficulty in practice. Even as it was, the method was much more satisfactory than other methods of arriving at the stray losses. There was a relationship between the temperature rise of the air and the losses; it was quite worth while to invert the process and measure the amount of air that was passed from the temperature rise. Suppose it was desired to know how much air went into a certain apparatus. Before the air was put in it could be passed through a ring in which there was a resistance. There would be also vanes and a number of thermo-couples. By passing a continuous current through that resistance one had a perfectly ascertained loss in the machine. The difference in temperature gave a very good measurement of the amount of air going through. The temperature could be measured to a hundredth part of a degree, and if there were 5 deg. rise in temperature in the air going through one got a very good measure of the air. It would be quite possible in turbo-generators to have something of that kind in the ducts, and in that way a very much more accurate measurement of the amount of air could be made. With regard to measurement of the temperature of the air going out, thermometers were rather troublesome. Using an ordinary shop thermometer the temperature might be read very carefully, but usually it was not worth while to do so. A very much better method was to put a large number of thermo-couples in parallel.

Mr. J. S. Peck said that a method which would enable losses to be measured under running conditions on site was likely to be generally adopted if it was found reliable. The important point in the paper seemed to him to be the design which the authors had worked out for securing a uniform distribution of air in the exhaust. The results which they had obtained were really remarkable; they were closer than one would expect to get any commercial measurements. If further tests showed that such accurate results could be obtained, he thought there was no doubt this method would be generally adopted for measuring the efficiency of turbo-alternators.

Mr. J. Firth said Dr. Walker had touched upon what was really the main point. He explained that Dr. Cramp and he had done a little work on the commercial measurement of air flow, and he then exhibited and explained the apparatus that they used. He thought it was a weak point to favour the anemometer because it did not take into account the direction of the air flow. In a duct such as the authors used air might be going in at one place and out at another. A "Pitot" tube would give the outward component of the air, which was what was wanted. The Morris resistance method would give too big an estimate of the quantity, and apparently did not differentiate between air going in and that coming out. Another method which might have been brought out more fully was only hinted at in the paper. A resistance heater was put right across the top in the form of a net, and a given amount of energy was supplied to it. The device was practically a platinum thermometer. The temperature rise could be measured very accurately as well as the amount of energy being put into the machine. It practically resolved itself into a rule of three, and did away with all air measurement. Of course, it was a direct calibration method, and it had been used very largely to measure the commercial rate of flow of gas in pipes. This method differed slightly from that suggested by Dr. Walker, and it seemed to the speaker that putting the platinum wire across to get the average temperature was better than putting thermo-couples in parallel. The heated thermo-couples would be sending current through the colder thermo-couples, which would alter the temperature.

Mr. H. C. Lamb thought the paper was of special interest to station engineers, because everyone who put in plant wished to test it himself after it was installed, but up to the present they had had to accept figures furnished by the makers, and he thought tests should be made by independent parties. The method described in the paper would settle disputes that might arise very easily on site, and the efficiency of alternators might be checked in this way, and a comparison made with the figures furnished by the makers. Recently he had tested a 20,000-kw. alternator which had been tested at the maker's works before delivery. The load was kept constant for several hours at 17,000 kw., 0.85 p.f., 6,600 volts. The air was measured by an anemometer similar to the one shown in the paper. It had been specially put in order for the test by the Manchester instrument department. The discharge duct was divided by cast-iron wedges into 16 compartments. The velocity was taken in each one of the 16 divisions, and the air volume worked out at 67,840 cu. ft. per minute. The inlet air temperature was 68.20 deg. F., and the outlet air temperature—which was taken by specially calibrated thermometers on the average of 24 readings—was 110.67, showing a temperature rise of 42.47. That gave the energy carried away by the air as 855 kw.; he assumed the loss through bearing friction at 100 kw., which gave 955 kw., and the radiation loss was neglected. Those two losses gave an efficiency of 94.7 per cent., and the efficiency furnished by the makers, taken from the curve of the tests at their works, was 94.6. After reading the paper, he measured up the surface of the carcase, which was 210 sq. ft., and, allowing 0.006 watt per sq. in., it gave 7½ kw. of loss. When that was allowed for it brought the efficiency to 94.65, against the 94.6 given by the makers; he thought that was a remarkably close result. He felt quite sure the method would be very widely used; it removed from his mind any lurking suspicion regarding the figures furnished by manufacturers—at any rate, by the particular manufacturer in question.

Mr. Kayser said that some years ago they had used the calibrated air temperature method on some large turbo-alternators to get an idea of the stray losses. They tried it on a 20,000-k.v.a. machine; the test was, however, not very accurate, but it showed that there was a fair agreement between the short-circuit and the load losses. Referring to the calibrated air-temperature method, he inquired why it was necessary to make two tests. He used one single test—either the full load or the short circuit. If the idea was to eliminate the short-circuit losses from the calibration losses, he did not see why it was necessary to do so. This loss was known just as accurately as the final loss, and it had the same effect on the temperature of the air. By including this loss in the calibration loss a greater effect could be obtained, and the expenditure would be reduced.

Mr. S. Juhlin thought the calibrated-motor method had very distinct advantages in so far that it was of extreme value to the designer to be able to segregate the losses in the machine with as much accuracy as possible. If it were necessary to run the machine until the temperature was perfectly steady, the time spent in making the tests must be very great, and he was afraid that power-station engineers generally would object to being tied up when the machine was ready for running. Results obtained by taking air measurements from a 5,000-kw. set were certainly encouraging. The discrepancies amounted to about 12 per cent., roughly speaking, between the loss obtained by ascertaining the separate losses and taking into account the short-circuit loss and the loss calculated from the air measurement and the temperature rise, but greater accuracy could be obtained with very careful measurement. It was really astonishing to see the steady flow of air which could be obtained by the use of the chimney. One or two points in the paper needed some clearing up. On page 2 the authors referred to the fact that, under short-circuit conditions, losses had been experienced which were not present on load conditions—at least, there was a temperature rise which indicated such losses. He would hardly think that was general experience. He thought that an agreement between the value of the stray loss on load and on short circuit, which was stated to be partly accidental and not to be expected in all cases, might be due to air measurement, and not to the losses, changing. Mr. Lamb's estimate of the bearing loss was very much above the actual figure. Tests had been made by taking the inlet and outlet temperatures of the water, and the actual loss in the two bearings was not more than 33 kw.

Mr. R. E. Grime agreed with Mr. Frith in his criticism of the Morris resistance method of measuring the air loss. What was required to be measured at the outlet of the exhaust chimney was the average velocity normal to the outlet. If the air was not moving normal to the plane of the outlet there were side components which were all included in the measurement by the Morris apparatus, and the average absolute velocity was higher than the average normal velocity. It was the latter that should be measured, not the absolute velocity. A point that would have to be considered relative to air filters was the effect of suspended moisture in the air. The humidity of the air did not matter much, but if there was any suspended free moisture in the air which was evaporated in passing through the machine greatly inaccurate results might be obtained.

Dr. Cramp said that the difficulties in connection with the method which the authors had put forward might be divided into two classes. The first of these referred to the amount of heat which went into the machine itself owing to the specific heat of the material of which it was made; it seemed to him certain that the machine itself could not have reached anything like a final temperature at the time the loss was measured; and nothing was said about the amount of heat which went into the machine during the calibration period; that was also true of the first method. Measurements must be taken at the end of a long run, and a correspondingly long run must always intervene between the time when the test was taken on one load and the time when the test was taken on another load. That made the whole method rather slow. The other difficulty was that of measuring the radiation from the

exterior of the machine. It seemed to him that the rule the authors gave for ascertaining the loss was far too rough to be of any service. Some machines were smaller in diameter than others. He was very much surprised that the authors referred to the anemometer as a satisfactory instrument. The process of taking readings over numerous sections was slow, and would lead to inaccuracies. The air velocity could not possibly be measured by traversing a "Pitot" tube across the discharge opening. The static gauge was more likely to give trouble than the dynamic, but there was no reason why the static tube should not be inside the duct, and square or flush with it. A safe place to put the tube for really accurate measuring was at the head of the duct, and a small hole quite flush with the face would give the best results. For really accurate measurement it was desirable to use a round, and not a rectangular, pipe for the air to pass through. He asked for the sizes of the machines tested, which the authors had not given.

Dr. S. P. Smith, in reply, said there might be some relation between the distribution of the magnitude of the stray loss on short circuit and on load; but he did not know that it had been discovered. With regard to the accurate measurement of the air velocity, he thought they ought to distinguish between commercial accuracy—the accuracy expected in an ordinary test-house or power station, which was good enough for practical purposes—and the accuracy expected when a scientific investigation was made. The accuracy obtained on those tests was sufficiently good for strictly scientific work, but if they could measure the mean velocity of the air to within 2 or 3 per cent. it was quite good enough for all practical purposes. He referred to Prof. MacGregor-Morris's instrument, and said there, again, it was not a question of absolute accuracy from their point of view. Prof. Walker and Mr. Frith had shown forms of good apparatus, and their methods doubtless were good, but they were really only other forms of what they had called the "calibrated air-temperature" method, and they should have the gear as simple as possible, so that it could be erected with very little trouble. No doubt thermo-couples could be used to measure the temperature, but they had not found any trouble with the thermometers, and the accuracy obtained with them was remarkable. They were very handy, and quite suitable for the purposes in view. With regard to the time occupied in the tests and the cost, he thought the results accruing therefrom would justify them; it was not a very serious matter to have to wait until the temperature became steady, and he thought that under most conditions a fairly constant load could be kept on the machine, even when it was working on a network load. They had found it so on large machines that they had tested. Large machines were too valuable and the results too important for small details to be considered too seriously. Mr. Lamb's figures were interesting, and very close—94.6 against 94.65—and such agreement between the maker and the power-station engineer was not always to be expected. Mr. Lamb had shown that on his 20,000-k.v.a. machine the radiation loss was only 7½ kw., and it only affected the efficiency by 0.05 per cent. Under those circumstances, it was not going to be an important item.

In addition to the brief abstract already reported on p. 276 of our issue of March 7th, we are now able to reproduce curves, and to give fuller details of Capt. A. H. Law's contribution to the discussion on this paper in London.

Capt. Law expressed his appreciation of the paper, and said that in his opinion it would place on a satisfactory basis what had for a long time been a matter of discussion between

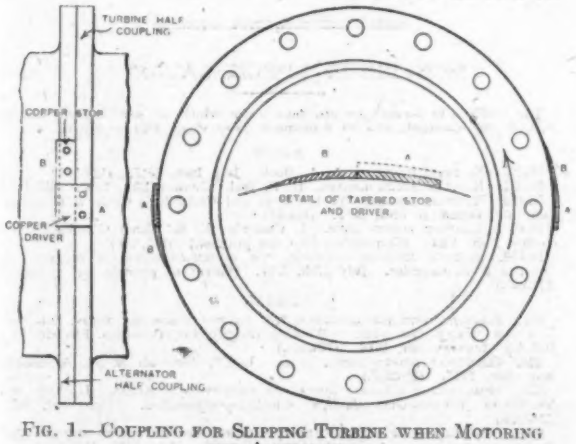


Fig. 1.—Coupling for Slipping Turbine when Motoring the Alternator.

the turbine builder and the electrical designer. His own firm had had two or three cases in which the efficiencies of alternators designed by other manufacturers had been questioned, and since 1910 he had constantly used air calorimetry for determining the efficiency of alternators of all sizes. Now that a description of these methods was to be on the records of the Institution there would be less hesitation on the part of persons interested in accepting them as accurate. The precautions which must be taken were clearly shown by the author, and he had little to add to these. It was worth remembering, however, that an anemometer was usually calibrated in cold air. It had been found, possibly owing to varying friction in the bearings of the instrument, that this calibration was not strictly accurate for air of the temperature which was usually reached in the outlet from turbo-alternators. The chimney method of air velocity measurement had been found to give good results. The "calibrated air temperature" method was used by Messrs. Parsons in 1910, when it became necessary accurately to determine the efficiency of some large alternators to which new and up-to-date turbines were being fitted. The method was almost exactly that described by the authors of this paper. The alternators were run as motors, and the power input and temperature rise accurately measured. This gave an indication of the quantity of air passing through the alternators, which were then run on load, and the efficiency was determined in the manner described by the authors. The method was also used in 1913, when there was a question of the efficiency of some large single-phase machines built on the Continent.

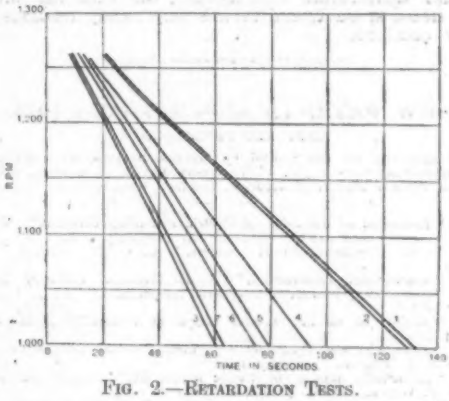


Fig. 2.—Retardation Tests.

It was found, as was expected, that the efficiency was considerably lower than the guaranteed figure. A method of determining the efficiency which included stray losses was of especial importance in the case of single-phase machines where these losses might be very considerable. He was not quite in agreement with the authors when they suggested that when using the "calibrated air temperature" method, the efficiency could not be determined solely by tests on site. In both the above cases the efficiency was determined solely in this way, and eventually figures were arrived at which satisfied all parties. The obvious difficulties in getting a large machine of this type up to synchronous speed and paralleling it in on the system independently of the turbine were got over by the use of the device shown in fig. 1. The coupling bolts which normally joined the halves of the flexible coupling were removed, and the halves of the coupling were connected by a soft copper driving strip A A, riveted to the turbine

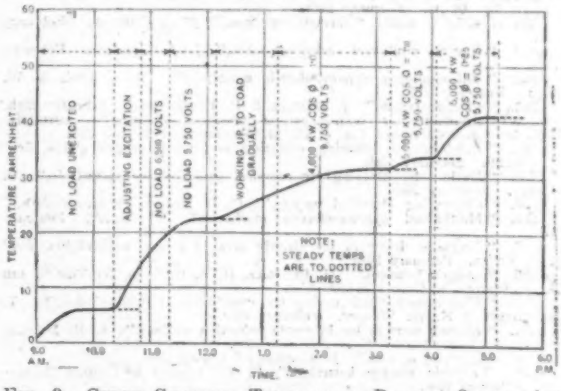


Fig. 3.—Curve Showing Temperature Rise of Outlet Air Above Inlet Air.

half of the coupling. This strip engaged with a tapered projecting stop piece on the alternator part of the coupling, as shown at B.B. When the turbine was started, A drove B, and the alternator was run up to speed and paralleled. The turbine was then shut down, when B ran ahead of A, and, being tapered, forced outwards that part of A which projected over the alternator half coupling, thus freeing the alternator from the turbine. The authors expressed doubts as to the accuracy of the retardation method of obtaining the no-load losses. He could not agree that this method was inaccurate if it was carefully done. It was used in 1912 for determining

the no-load losses on one of the 5,000-KW. turbo-alternators at Carville. Fig. 2 showed a set of retardation tests which were made on one of these alternators. No. 1 curve showed the rate of slowing up of turbine and alternator when the alternator was unexcited. No. 2 was a similar curve with the alternator running at about one-tenth of its rated voltage. No. 3 was the deceleration curve at one-tenth voltage and with a load of 100 KW. as a calibration. Nos. 4, 5, 6, and 7 were deceleration curves with no load and at different terminal voltages. Curve 3, when used in conjunction with calculations of the stored energy of the parts, supplied a calibration for determining the no-load losses for the different voltages represented by curves 4, 5, 6, and 7. The normal speed of the machine was 1,200 R.P.M.; in taking these tests the speed was run up to over 1,300 R.P.M., the readings being commenced at about 1,260 R.P.M. The voltage of the alternator was kept steady by hand manipulation of the regulating rheostat. Fig. 3 showed the final stage of the efficiency determination, the whole of the tests having been carried out between 9 a.m. and 5 p.m. on the same day. In each case the curves were artificially steadied up by raising the voltage or load to a rather greater amount than that shown opposite each flat portion of the curve. As soon as the estimated temperature was reached, the load was brought to the stated amount, and in this way steady readings were quickly obtained.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

4,065. "Reduction of distortion of electric signalling currents." Western Electric Co. (Western Electric Co., U.S.A.) February 18th.
4,068. "Electric incandescent lampholders." C. G. M. Bennett. February 18th.
4,098. "Electric bell construction." A. E. Hughes. February 19th.
4,099. "Self-locking incandescent electric lampholders." C. J. Crockett. February 19th.
4,101. "Method of locking electric lamps in holders." J. H. Collie. February 19th.
4,110. "Storage-battery separators and insulators and process of making same." D. A. Palmer. February 19th.
4,111. "Detachable fixings for electric lamps, &c." Fuller Accumulator Co. & A. P. Welch. February 19th.
4,116. "Inter-communication telephone systems." L. C. Bygrave. February 19th.
4,128. "Anodes." J. Schledorn. February 19th.
4,149. "System for transmitting high-frequency electric currents." Western Electric Co. (Western Electric Co., U.S.A.) February 19th.
4,151. "Electrical resistances." L. F. A. Fogarty & C. T. Lehmann. February 19th.
4,153. "Switches." J. Etchells, C. H. Stedman & Vickers, Ltd. February 19th.
4,162. "Electrical contact makers." J. L. Scott. February 19th.
4,166. "Induction regulators." G. Pestarini. February 19th.
4,168. "Rotary current collectors for electric machines." G. Pestarini. February 19th.
4,169. "Arrangements for increasing power factor of asynchronous motors." G. Pestarini. February 19th.
4,176. "Switch apparatus for ignition circuit of automobile." A. G. Tonks, C. A. Tonks, C. W. Tonks, G. A. Tonks and E. Tonks & Sons. February 20th.
4,178. "Alternating motor and measurer." F. W. Bawden. February 20th.
4,188. "Electrical switches." J. H. Thorne. February 20th.
4,192. "Trolley-wheel mechanism of overhead electric tramway systems." H. V. Richardson. February 20th.
4,196. "Connecting span wires and fittings for suspension of trolley wires in overhead wire systems of electric traction." Brecknell, Munro & Rogers and A. M. Willis. February 20th.
4,214 to 4,219 & 4,221. "Electric switches." J. A. Crabtree. February 20th.
4,220. "Electric plug and socket switches." J. A. Crabtree. February 20th.
4,222. "Self-regulating dynamo-electric machines." Brolt, Ltd., & W. Holt. February 20th.
4,234. "Electric lamps." J. Drabble & E. Farnsworth. February 20th.
4,244. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co. & H. M. Friendly. February 20th.
4,253. "Long-arm for removing, replacing, or cleaning electric globes, &c." R. Taylor. February 20th.
4,268. "Devices for carrying out chemical processes by electrolysis." V. Gerber. February 20th.
4,286. "Controlling electrical energy." C. D. Ehret. February 20th.
4,291. "Multi-speed dynamo-electric machines." F. Creedy. February 20th.
4,299. "Magnetic deflectors for electric arcs in lamps, searchlights, &c." J. P. Yorke. February 20th.
4,320. "Electric furnaces." H. Etchells, H. A. Greaves, W. Travis, and T. H. Watson & Co. February 21st.
4,342. "Electro-mechanical device for variable-speed transmission." T. Humphreys & H. H. Wright. February 21st.
4,375. "Electric starters for internal-combustion engines." A. H. Midgley and C. A. Vandervell & Co. February 21st.
4,382. "Electrolytic cell." J. Harris. February 21st.
4,386. "Electric storage batteries." E. W. Clarke & London Battery Co. February 21st.
4,387. "Assembling electric batteries." E. W. Clarke & London Battery Co. February 21st.
4,459/60. "Electrical signalling systems for mines." Automatic Telephone Manufacturing Co. & H. Green. February 22nd.
4,469. "Electric iron." R. F. Bruce & Gortholme Aircraft Co. February 22nd.
4,472. "Mono-polar electrode electrolysers." G. G. Hepburn. February 22nd.
4,483. "Telephone indicators or annunciators." F. G. Bell & Sterling Telephone & Electric Co. February 22nd.
4,488. "Multiplex telegraphs." G. Pestarini. February 22nd. (Italy, April 3rd, 1917.)
4,490. "Production of nitrogen compounds containing hydrogen with aid of electric discharges." F. Gros et Bouchardy. February 22nd. (Switzerland, February 25th, 1918.)
4,509. "Electrical accumulators." C. H. Worsnop. February 24th.
4,520. "Protector for electric lamp globes." C. V. Burton. February 24th.
4,542. "Sparking plug." A. Sproul. February 24th.
4,555. "Rotary switch." C. Braun. February 24th.
4,564. "Self-starting synchronous motors." H. O. Burge & Crompton and Co. February 24th.
4,573. "Electric terminals." J. W. Ewart. February 24th.
4,579. "Arrangement and connector for jointing electrical wires." J. S. Mollerhoj. February 24th.
4,586. "Ignition magnetos." E. C. R. Marks (Splitdorf Electrical Co.). February 24th.
4,592. "Electromechanical pocket lamps." K. K. K. Moller. February 24th.
4,600. "Production of nitrogen compounds containing hydrogen with aid of electric discharges." F. Gros et Bouchardy. February 24th. (Switzerland, October 2nd, 1918.)
4,622. "Electrodes for electrolytic recovery of metals from solutions." H. Wade (Central Coal Mining & Investment Corporation). February 24th.
4,623. "Electrolytic recovery of metals from solutions." H. Wade (Central Mining & Investment Corporation). February 24th.
4,630. "Method of electrically welding platinum, &c., disks to ends or heads of metal screws or rods." W. Meacher. February 25th.
4,637. "Dynamo-electric machinery." D. D. Rayner. February 25th.
4,650. "Electric flashlamp, bell, &c." J. F. Lister & G. Verity. February 25th.
4,671. "Reception arrangements for wireless telegraph and telephone systems." L. J. B. Verdier. February 25th.
4,709. "Alternating-current lighting apparatus." S. Salto. February 25th. (Italy, February 28th, 1918.)
4,719. "Electric motor cars." K. H. O. Lubeck. February 25th. (Sweden, February 25th, 1918.)
4,726. "Telephonic systems." E. A. Graham. February 25th.
4,745. "Electric connections." G. Duveau. February 25th. (Belgium, March 18th, 1914.)
4,751. "Electric selective signalling." Western Electric Co. February 26th.
4,755. "Telegraph systems." Automatic Telephone Manufacturing Co. and H. H. Harrison. February 26th.
4,791. "Circuits for incandescent lamps." C. C. Garrard & A. H. Railing. February 26th.
4,798. "Electric heaters for internal-combustion engines." H. G. Byrnes and S. B. Depree. February 26th.
4,811. "Fittings for electric, &c., lamps." E. H. R. W. Eyre & W. Harrison. February 26th.
4,817. "Means for securing electric lamps or lampholders to hand lamps, &c." E. H. R. W. Eyre & W. Harrison. February 26th.
4,828. "Electric helm indicators." Siemens Bros. & Co. and F. Turner. February 26th.
4,833. "Electric discharge devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 26th.
4,836. "Lock-out switches." R. P. Bossom & V. Breeze. February 26th.
4,840. "Ignition switches." A. H. Midgley & C. A. Vandervell & Co. February 26th.
4,841. "Induction coils." A. H. Midgley & C. A. Vandervell & Co. February 26th.
4,847. "Magnetic chucks." F. S. Blackhall. February 26th. (U.S.A., February 26th, 1918.)
4,848. "Electrodes and welding, &c., rods used in soldering and depositing metals." Alloy Welding Processes, Ltd., & E. H. Jones. February 26th.
4,850. "Trolley wheels for transmitting electricity for electric traction." G. H. Armitage, J. H. Rogers & S. W. Shaw. February 26th.
4,865. "Electric switches." E. A. Fagerlund. February 26th. (Sweden, September 6th, 1918.)
4,870. "Electric time switches." H. Goldman. February 26th.
4,876. "Alternating-current electrical apparatus for selective transmission of signals." F. M. Lewis. February 27th.
4,879. "Motor starters, rheostats, &c." L. K. Vier. February 27th.
4,887. "Automatic electric control apparatus." S. H. Adams. February 27th.
4,897. "Electric motors." F. Foster. February 27th.
4,898. "Coverings of conduits for laying electric cables." C. G. Warne. February 27th.
4,923. "Chemical processes conducted in electrical furnaces." H. Dreyfus. February 27th.
4,940. "Protective devices for electric circuits." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 27th.
4,948. "Electrolysis." M. A. Adams, J. Fieldhouse, A. T. Mabbitt & J. Stevenson. February 27th.
4,955. "Trolley for electric tramways." G. Odierno. February 27th.
4,970. "Production of tone currents for telephone circuits." W. H. Grinsted and Siemens Bros. & Co. February 27th.
4,973. "Combined telephone pad and directory holder." H. J. Carter and C. W. H. Westell. February 27th.
4,982. "Sockets for electric lamps." J. Wegmann. February 27th. (Switzerland, June 18th, 1918.)
4,983. "Self-contained battery lamps." British Ever-Ready Co. & M. Goodfellow. February 27th.
4,990. "Electrical push apparatus for mines, &c." A. H. Marsh. February 28th.
4,999. "Electric poultice." G. S. Plant. February 28th.
5,006. "Combined electrical couplings and base-plates." R. W. Bill and W. T. Bower. February 28th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

10,243. Electric heaters. A. A. Buck. July 16th, 1917. (123,106.)
14,991. Electric accumulators. H. F. Joel. October 16th, 1917. (123,110.)
18,453. Electric cables. W. Williams and Callender's Cable & Construction Co. December 12th, 1917. (123,124.)
18,649. Electric pocket lamp. J. Chatwin (E. G. Comp, Phœbus). December 15th, 1917. (Convention date not granted.) (113,953.)
18,750. Electric ignition apparatus for internal-combustion engines. J. Courtier & P. Courtier. July 12th, 1917. (Patent of addition not granted.) (118,080.)

1918.

411. Electron emitting cathodes for vacuum discharge tubes, and process for making the same. Western Electric Co. (Western Electric Co., U.S.A.) January 8th, 1918. (123,126.)
423. Electrically-fired small arms. L. M. Bowman & W. A. Smith. May 29th, 1917. (116,257.)
474. Incandescent electric lamps for projection purposes. D. Lely and Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 2nd, 1917. (116,686.)
2,415. Protection of electric supply distribution systems in which shunt wires are employed. A. V. Downton. February 11th, 1918. (123,143.)
2,416. Electric measuring and circuit-projecting apparatus. A. V. Downton. February 11th, 1918. (123,144.)
2,494. Electric current controllers. Y. Uchida. February 12th, 1918. (123,148.)
2,545. Electric master and secondary clocks. P. P. Andersen. February 12th, 1918. (123,155.)
2,768. Apparatus for demonstrating systems of electric wiring. D. Rowan. February 16th, 1918. (Cogante application 4,397/18.) (123,170.)
2,800. Electric clocks. P. P. Andersen. February 16th, 1918. (123,171.)
5,774. Electrical speed-controlling apparatus. V. Bibire. April 4th, 1918. (123,216.)